Silvicultural Prescription for the Baker Creek Density Management Project

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Location:

The Baker Creek density management project is located in T. 3S., R. 6W., Sections 25 and 35; T. 4S., R. 6W., Section 1; T. 4S., R. 5W., Section 7; and T. 3S., R. 5W., Sections 29, 31, and 33, W.M.

Management Direction and Objectives:

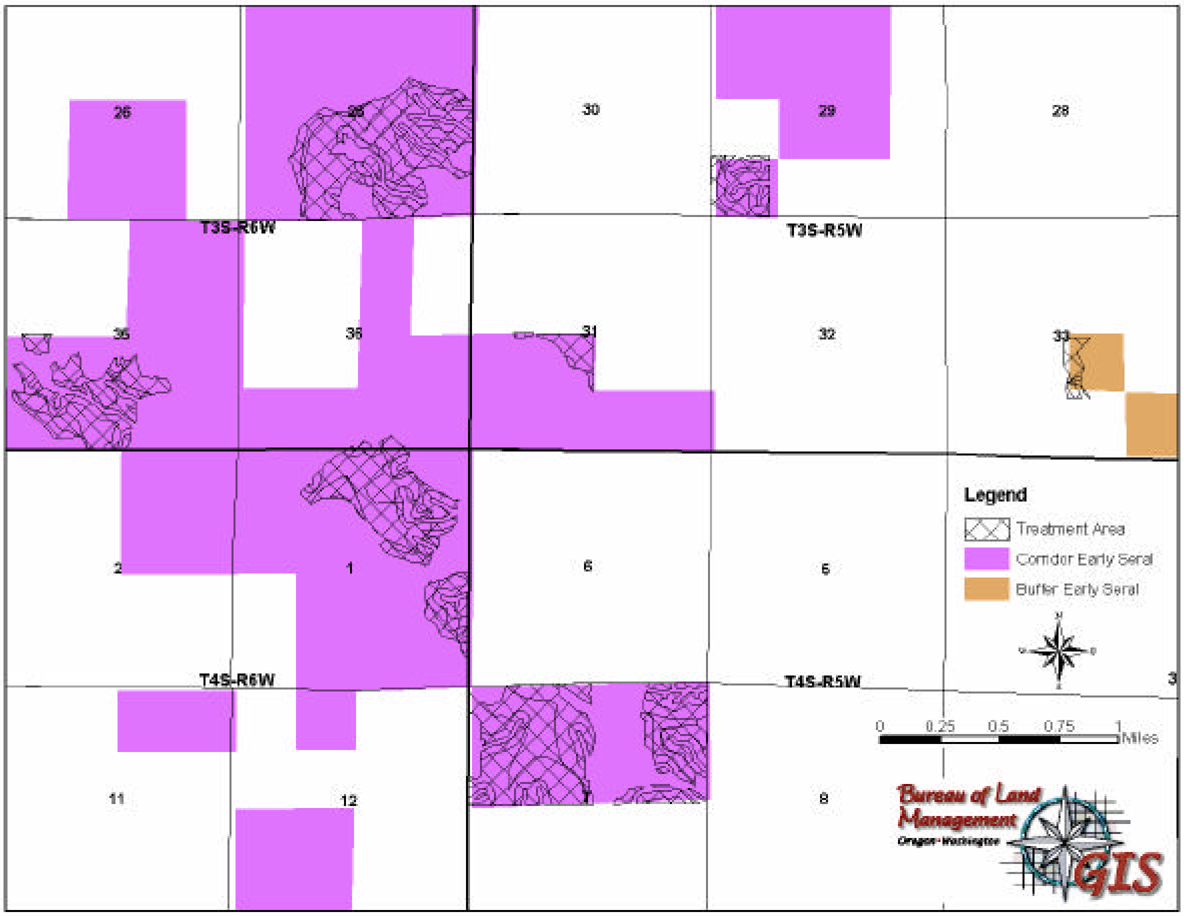
A. Introduction

RMP land-use allocation: The proposed project is within the Northern Coast Range Adaptive Management Area (AMA), as identified in the Salem District Record of Decision and Resource Management Plan (ROD/RMP) (USDI Bureau of Land Management 1995). Within AMA's, agencies are encouraged to undertake new management approaches and evaluate their outcomes. The purpose of the Northern Coast Range AMA is primarily to restore and maintain late-successional forest habitat, consistent with marbled murrelet guidelines. The proposed project area also contains Riparian Reserves.

LSRA Landscape Cell and Zone: The Late-Successional Reserve Assessment for Oregon's Northern Coast Range Adaptive Management Area identified the great majority of the area as part of the Corridor/Early Seral landscape cell and zone (USDA Forest Service and USDI Bureau of Land Management 1998). One very small area on the extreme east end of the project area (T. 3S., R 5W., Section 33) is part of the Buffer/Early Seral landscape cell and zone. The landscape zones and cells for the project area are shown in Figure 1.

The corridor landscape zone is intended to provide connectivity to the surrounding Late-Successional Reserve network, and to state and private lands. The buffer landscape zone is intended to provide refugia for late-seral species in parts of the assessment area that will probably continue to be dominated by early and mid-seral stands. Specifically, the goals of the corridor zone are to (1) improve, create, and maintain late-successional habitat connectivity and dispersal habitat, especially between Reserve Pair Areas and (2) increase late-successional habitat connectivity and dispersal habitat within the larger Late-Successional Reserve network and within late-successional blocks on state and private lands outside of the assessment area. The specific goals of the buffer zone are to (1) maintain and increase late-seral habitat connectivity and dispersal habitat and (2) develop and maintain refugia for species that depend on late-seral habitat.

Figure 1. Landscape zones and cells for the Baker Creek Density Management Project area.



Management goals for early-seral landscape cells located in the corridor landscape zone are as follows:

- Identify Key Watersheds and anadromous fish “core areas” in need of restoration and apply silvicultural treatments having a high degree of certainty of accelerating development of late-seral forest habitat.
- Maintain and enhance dispersal habitat for species associated with late-seral forests.
- Protect and buffer existing small patches of late-seral habitat.
- Apply silvicultural treatments having a high degree of certainty of accelerating development of late-seral forest habitat around T&E species locations to enlarge existing, small scattered patches of late-seral forest habitat.
- Reduce or eradicate exotic species.

Management goals for early-seral landscape cells located in the buffer landscape zone are as follows:

- Identify Key Watersheds and anadromous fish “core areas” in need of restoration and apply silvicultural treatments having a high degree of certainty of accelerating development of late-seral forest habitat.
- Maintain and enhance dispersal habitat for species associated with late-seral forests.
- Protect and buffer existing small patches of late-seral habitat.
- Apply silvicultural treatments having a high degree of certainty of accelerating development of late-seral forest habitat around T&E species locations to enlarge existing, small scattered patches of late-seral forest habitat.
- Reduce or eradicate exotic species.
- Maintain diversity by managing special habitats for non-late-seral species.
- Maintenance of natural processes.

The objectives of the treatments contained in this prescription for areas planned for density management are to accelerate the development of some late-successional forest structural features, including large trees, gaps in the canopy, snags and down logs, various levels of overstory tree densities, and various levels of understory development. Specific treatments to reduce the impact and spread of laminated root rot, caused by the fungus *Phellinus weirii*, are also included. Implementation of this prescription will enhance the overall level of diversity in this area, and it will set the stage for future treatments that could continue this process, if such treatments were determined to be necessary at that time. In addition, implementation of this prescription will supply timber to local mills.

In addition, two specific AMA learning objectives are contained in this project: (1) comparing two strategies for managing areas of severe *P. weirii* root disease infestation and (2) determining if *individual* large-diameter trees can be developed by relatively wide thinning in selected areas (six small patches of approximately 0.12 acre each) within the Riparian Reserve, including a portion of the 50-foot “no-harvest” buffer, along an intermittent, non-fish-bearing stream without causing unacceptable short-term impacts to the stream. These AMA learning objectives are discussed in detail in Attachments 1 and 2, respectively.

B. Watershed perspective

The area proposed for treatment lies within the Deer Creek, Panther Creek, Willamina Creek, and South Yamhill Watershed Analysis area (USDI Bureau of Land Management 1998). Using density management to accelerate tree growth, structural development, and additions of coarse woody debris are recommendations contained in the watershed analysis.

C. Selection of the proposed treatment areas and general stand description

The relatively root-disease-free areas proposed for treatment included in the Baker Creek Density Management Project consist of relatively dense, single-storied Douglas-fir stands that are of an age and condition that should respond favorably to careful intervention designed to increase the development of late-successional forest features. Grand fir, western hemlock, and hardwoods occur in the treatment units in varying amounts. Red alder and bigleaf maple dominate the hardwood component. Red alder is the most common hardwood tree. On the average, hardwoods account for nearly 10% of the basal area of the stands recommended for density management and ranges from 0 to 30% among the individual stands. Red alder appears to be most abundant in riparian areas. Bigleaf maple occurs most frequently in the stands near the eastern edge of the proposed project area, particularly in units 7-2, 7-3, 29-1, 31-1 and 33-1. Other than in riparian areas, hardwoods often appear to be associated with openings in the Douglas-fir overstory canopy caused by *P. weirii* root rot.

Without density management at this time, the development of many late-successional forest structural features would occur at a much slower rate because the overstory is becoming increasingly dense and uniform. Portions of Units 1-1 and 25-1 have particularly extensive and severe *P. weirii* root disease centers that if left untreated, are on a trajectory to greatly reduce the potential to develop late-successional forest features as well as the reduce forest productivity. Units 7-1 and 35-2 also have some significant *P. weirii* root disease infection centers. Selection of these units for treatment is consistent with the recommendations contained in the Deer Creek, Panther Creek, Willamina Creek, and South Yamhill Watershed Analysis (USDI Bureau of Land Management 1998). The current overstory (trees = 7 inches DBH) stand attributes, including the site-potential tree heights for Riparian Reserve width determination for the proposed treatment units are shown in Table G-1.

Table G-1. Overstory (trees = 7 inches DBH) stand attributes, including site-potential tree heights for Riparian Reserve width determination for the density management thinning units in the Proposed Action in the environmental assessment for the Baker Creek Density Management Project.

Unit	Total age (yrs)	Ac[1]	Trees/ ac[2]	Basal area/ac (sq ft)	QMD (in)[3]	Relative density index[4]	50-yr site index (ft)[5]	Site-potential tree height (ft)	Mean crown ratio	Height of 40 largest trees/ac (ft)
1-1	47	103	251.6	283.1	14.4	0.865	131	220	0.369	119
1-2	57	25	194.9	290.1	16.5	0.838	131	220	0.384	123
7-1	50	139	142.4	192.5	15.7	0.567	126	200	0.310	101
7-2, 3	34	64	232.0	160.4	11.3	0.539	135	220	0.473	87
25-1	41	167	331.5	236.1	11.4	0.789	123	200	0.456	94
29-1	46	32	261.7	192.0	11.6	0.638	120	200	0.315	97
31-1	66	16	222.0	238.6	14.0	0.735	101	180	0.441	119
33-1	52	11	310.5	288.3	13.0	0.914	120	200	0.253	116
35-1, 2	53	90	261.2	284.1	14.1	0.873	117	200	0.417	110
Total		647								

[1]Estimated acres for the Proposed Action in the Environmental Assessment rounded to the nearest whole acre. [2]Overstory component (trees = 7 inches dbh) for healthy (relatively disease-free) plots. [3]Quadratic mean diameter (diameter of the tree of average basal area). [4]Proportion of maximum Stand Density Index (Reineke 1933). [5]Douglas-fir 50-year site index (King 1966).

Except where *P. weirii* root rot has caused various-sized openings or areas of lower density, most of the proposed treatment areas have relatively dense overstory canopies, which limit the amount of light reaching the forest floor, and therefore, understory development. Where there is sufficient light reaching the forest floor, the most abundant understory species include salal, vine maple, swordfern, dwarf Oregon grape, and oceanspray. In Unit 25-1, there are extensive pockets of severe *P. weirii* root rot infection that have little Douglas-fir overstory remaining. As a result, these areas support a very dense shrub layer consisting of varying amounts of vine maple, oceanspray , and salal. The height of the shrub canopy is commonly 15 to 20 feet. Unit 1-1 also has extensive brush- and hardwood-dominated root disease infection centers.

Understory conifers (trees = 7 inches DBH) occur in most units (Table G-2). Douglas-fir, western hemlock, and grand fir are the dominant understory conifers. The understory conifers generally have a somewhat patchy distribution.

Table G-2. Understory (trees = 7 inches DBH) conifer data for the density management thinning units in the Proposed Action in the environmental assessment for the Baker Creek Density Management Project.

Unit	Trees/ac	Basal area/ac (sq ft)[1]	QMD (in)[2]	Species (species composition by trees/ac)
1-1	2.3	0.3	4.8	Douglas-fir (72%), grand fir (14%), western hemlock (14%)
1-2	50.8	0.9	1.7	Douglas-fir (14%), western hemlock (86%)
7-1	0.0	0.0	0.0	No understory trees occurred in the sample plots
7-2, 3	44.4	6.4	5.1	Douglas-fir (74%), grand fir (13%), western hemlock (13%)
25-1	77.4	8.3	4.4	Douglas-fir (79%), western hemlock (21%)
29-1	120.0	12.2	4.3	Douglas-fir (50%), grand fir (50%)
31-1	150.0	12.9	4.0	Douglas-fir (87%), grand fir (13%)
33-1	20.0	0.0	0.0	Grand fir (100%)
35-1, 2	25.7	1.4	3.2	Douglas-fir (5%), western hemlock (95%)

[1] The basal area for trees less than 4.5 feet in height is 0.0. [2]Quadratic mean diameter (diameter of the tree of average basal area). The quadratic mean diameter for trees less than 4.5 feet in height is 0.0.

Density management of these stands would be appropriate to promote overstory tree growth and stability, increase individual tree vigor, develop larger-sized trees (some of which could be used for future coarse woody debris input), and encourage some understory development—both on upland sites and in the Riparian Reserves. Because of the relatively high density of these stands, and the presence of *P. weirii* root rot, a moderate level of density management thinning is suggested at this time, except in selected six small patches within the Riparian Reserves as part of our AMA learning objectives to create some individual large-diameter conifers within the Reserves in Unit 25-1.

D. Stand history and description:

BLM records show that Units 25-1, 7-2, 7-3, and 29-1 were all planted with two-year-old bare-root Douglas-fir seedlings at a density of about 680 trees per acre (equivalent to a spacing of 8 X 8 feet) following clearcut harvest. The origin of the remaining units is not known, but may have regenerated naturally following fire. The western portion of Unit 31-1 was commercially thinned in 1976.

The live overstory tree data for the units proposed for density management thinning are shown in Table SD-1. The overall quadratic mean diameters for the units range from 11.3 to 16.5 inches, the mean crown ratios vary from 0.253 to 0.473, and the relative density index values (indices to the level of competition among the trees within a stand) range from 0.539 to 0.914, with nearly 78% of the units having relative density index values above 0.6. Above relative density index 0.6, Douglas-fir stand growth and vigor declines and mortality of the smaller-sized trees begins because of strong tree-to-tree competition for the available site resources. In addition,

Table SD-1. Live overstory (trees = 7 inches DBH) data for the density management thinning units in the Proposed Action in the environmental assessment for the Baker Creek Density Management Project.

Unit	Species	Trees/ Ac	Basal area/ac	QMD (in)[1]	Relative Density index[2]	Mean crown ratio	Trees/ac >20 in. dbh
1-1	Douglas-fir	224.0	253.7	14.4			
	Grand fir	2.0	6.3	24.0			
	Western hemlock	1.1	3.3	23.5			
	Hardwoods[3]	24.6	19.8	12.1			
	All species	**251.6**	**283.1**	**14.4**	**0.865**	**0.369**	**25.8**
1-2	Douglas-fir	143.7	235.7	17.3			
	Grand fir	1.1	4.5	27.4			
	Western hemlock	7.8	9.1	14.6			
	Hardwoods	42.4	40.8	13.3			
	All species	**194.9**	**290.1**	**16.5**	**0.838**	**0.384**	**36.7**
7-1	Douglas-fir	116.2	165.0	16.1			
	Grand fir	17.1	22.5	15.5			
	Hardwoods	9.2	5.0	10.0			
	All species	**142.4**	**192.5**	**15.7**	**0.567**	**0.310**	**21.0**
7-2, 3	Douglas-fir	203.4	135.7	11.1			
	Grand fir	6.2	7.7	15.1			
	Hardwoods	22.5	17.0	11.8			
	All species	**232.0**	**160.4**	**11.3**	**0.539**	**0.473**	**0.6**
25-1	Douglas-fir	304.6	223.5	11.6			
	Western hemlock	10.9	6.1	10.1			
	Hardwoods	16.0	6.5	8.6			
	All species	**331.5**	**236.1**	**11.4**	**0.789**	**0.456**	**0.9**
29-1	Douglas-fir	163.9	132.0	12.2			
	Hardwoods	97.7	60.0	10.6			
	All species	**261.7**	**192.0**	**11.6**	**0.638**	**0.315**	**8.5**

[1]Quadratic mean diameter (diameter of the tree of average basal area). [2]Proportion of maximum Stand Density Index (Reineke 1933). [3]Red alder and bigleaf maple.

Table SD-1, continued. Live overstory (trees = 7 inches DBH) data for the density management thinning units in the Proposed Action in the environmental assessment for the Baker Creek Density Management Project.

Unit	Species	Trees/ Ac	Basal area/ac	QMD (in)[1]	Relative Density index[2]	Mean crown ratio	Trees/ac >20 in. dbh
31-1	Douglas-fir	213.6	228.5	14.0			
	Grand fir	4.3	3.4	12.0			
	Hardwoods[3]	4.2	6.7	17.1			
	All species	**222.0**	**238.6**	**14.0**	**0.735**	**0.441**	**20.3**
33-1	Douglas-fir	206.9	239.4	14.6			
	Grand fir	1.9	5.4	22.8			
	Hardwoods	101.7	43.5	8.9			
	All species	**310.5**	**288.3**	**13.0**	**0.914**	**0.253**	**18.9**
35-1 & 2	Douglas-fir	227.2	262.9	14.6			
	Western hemlock	34.0	21.2	10.7			
	All species	**261.2**	**284.1**	**14.1**	**0.873**	**0.417**	**22.5**

[1]Quadratic mean diameter (diameter of the tree of average basal area). [2]Proportion of maximum Stand Density Index (Reineke 1933). [3]Red alder and bigleaf maple.

nearly 89% of the stands have height:diameter ratios of 90 or more when calculated from the quadratic mean diameter for the Douglas-fir stand component and the height of the 40 largest trees per acre. The height:diameter ratio is an index to stand stability. Wonn and O'Hara (2001) reported that stability for several conifer species in western Montana, including Douglas-fir, decreases because of susceptibility to damage from wind and snow above a height:diameter ratio of about 80.

E. Forest health:

The primary forest health issues are the extensive areas of laminated root rot, caused by the fungus *P. weirii,* is a native root pathogen that is a natural part of many forest ecosystems (Thies and Sturrock 1995). *P. weirii* is particularly severe in Units 25-1 and 1-1. In these units the amount of area estimated to be in *P. weirii* root disease centers are 33% and 20%, respectively. Units 7-1 and 35-2 also have obvious *P. weirii* root disease centers. In the remainder of the units, the amount of area in *P. weirii* root disease centers is estimated to be 10% or less.

Douglas-fir and grand fir are highly susceptible to *P. weirii*, (they are readily infected and killed by it); western hemlock is intermediately susceptible; western redcedar is tolerant or resistant; and all hardwoods are immune (Hadfield et al. 1986). *P. weirii* kills trees directly or makes them prone to windthrow because the disease decays their root systems. Diseased stands usually contain twice as many infected trees as those that are dead or exhibiting crown symptoms (Thies

1984). Tree-to-tree spread is through root contacts with infected trees or stumps (Hadfield et al. 1986). Disease centers are believed to expand radially at the rate of about one foot per year (Nelson and Hartman 1975). *P. weirii* attacks susceptible hosts regardless of tree size, age, or vigor. Tree killing by *P. weirii* creates openings in the canopy where shrubs, hardwoods, or shade- and disease-tolerant conifer species may occupy these various-sized gaps (Thies and Sturrock 1995). Because infected trees are windthrown or die standing, the disease can be a source of down wood and snags. With the exception of Units 1-1, 7-1, 25-1 and 35-2, most root disease centers appear to be less than ½-acre in size. In contrast to most of the root disease centers in the project area that have filled in with shrubs and hardwoods, the disease center in the northeast portion of Unit 35-2 has filled in with mostly western hemlock as the Douglas-fir has either been windthrown or died and remained standing.

Fresh down Douglas-fir trees encourage the build-up of Douglas-fir beetle populations, which subsequently attack and kill Douglas-fir trees. Douglas-fir trees weakened by root disease infection are more likely to be attacked by Douglas-fir beetles (Hadfield 1985). When the number of windthrown Douglas-fir trees greater than 12 inches in diameter is three or more per acre, the numbers of beetles produced is sufficient to cause infestation and mortality of standing live Douglas-fir trees (Hostetler and Ross 1996).

There are few other significant potential biological threats to forest health. There is some risk of windthrow and breakage from severe winter storms (especially since the height:diameter ratios are relatively high), or to some extent, wildfire. Following partial-cut harvest, the potential for windthrow would be greater for the next decade (generally the first few years following density management thinning). The upper lee slopes of major southeast- to northwest-running ridges generally experience the highest degree of windthrow in the Oregon Coast Range (Ruth and Yoder 1953). Although Swiss needle cast is present in the area, the level of infection is relatively low, and therefore, does not appear to be a major concern for the Douglas-fir stands in the area at this time.

F. Coarse wood:

The average total coarse woody debris levels for all decay classes combined (includes both down wood and snags) in the stands included in the proposed density management thinning areas and in some of the surrounding stands are shown in Table CW-1. There is considerable variation in the amount of down wood, snags, and total coarse wood volume among the units. As an overall average weighted by acres, there are 2,348 cubic feet per acre of total coarse wood in the units and adjacent stands according to the forest survey data collected. This level of total coarse wood falls within the high range (1,980 to 3,800 cubic feet per acre for Oregon Coast Range stands 25 to 49 years old and 1,980 to 4,840 cubic feet per acre for stands 50 to 79 years old), according to the Late-Successional Reserve Assessment for Oregon's Northern Coast Range Adaptive Management Area (USDA Forest Service and USDI Bureau of Land Management 1998). Approximately 92% of the total coarse wood volume, however, is from down wood, and only 8% is from snags. About 25% of the down wood is in decay classes 1, 2, and 3, and about 75% in is decay classes 4 and 5 on the average.

The detailed down wood data for each of the units (includes portions of the adjacent stands in some cases) proposed for density management are presented in Tables DW-1 through DW-9, and the corresponding detailed snag data for the units are presented in Tables DW-1 through DW-9 and Tables SN-1 through SN-9.

Table CW-1. Volume (cubic feet per acre) of coarse wood (conifer down wood and snags) in the units proposed for density management in the Proposed Action of the environmental assessment for the Baker Creek Density Management Project and portions of the adjacent stands (all decay classes combined)[1].

		Coarse wood component						
Unit	Total age (yrs)	Down wood volume (cu ft/ac)	Down wood volume (%)	Snag volume (cu ft/ac)	Snag volume (%)	Total volume (cu ft/ac)	LSRA coarse wood level category[3]	LSRA coarse wood level category range[3] (cu ft/ac)
1-1	47	2,094	91	216	9	2,310	High	1,980-3,800
1-2	57	1,442	89	180	11	1,622	Moderate	1,100-1,980
7-1	50	2,153	88	284	12	2,437	High	1,980-4,840
7-2, 3	34	869	98	20	2	889	Minimum	525-1,100
25-1	41	1,494	96	60	4	1,554	Moderate	1,100-1,980
29-1	46	1,600	88	209	12	1,809	Moderate	1,100-1,980
31-1	66	711	62	438	38	1,149	Moderate	1,100-1,980
33-1	52	1,153	60	779	40	1,932	Moderate	1,100-1,980
35-1, 2	53	4,846	97	174	3	5,020	High	1,980-4,840
Weighted average[2]		**2,171**	**92**	**177**	**8**	**2,348**		

[1]Includes data from forest survey plots in portions of the stands adjacent to the unit proposed for density management. [2]Weighted by forest survey acres. [3]Late-Successional Reserve Assessment for Oregon's Northern Coast Range Adaptive Management Area (USDA Forest Service and USDI Bureau of Land Management 1998).

Coarse wood data for Unit 1-1:

Table DW-1 presents the weighted average volume of conifer down wood in cubic feet per acre by diameter class, decay class, and piece length in Unit 1-1 and portions of the adjacent stands.

Table DW-1. Weighted average[1] volume of conifer down wood[2] by diameter class, decay class, and piece length for Unit 1-1 in the Proposed Action in the environmental assessment for the Baker Creek Density Management Project and portions of the adjacent stands[3].

Diameter Class	Cubic feet per acre					
	Decay class 1	Decay Class 2	Decay class 3	Decay class 4	Decay Class 5	Total
3-8	13	25	13	7	11	69
9-12	30	39	46	37	60	212
13-15	22	24	0	100	47	193
16-19	25	26	0	132	86	269
20-23	0	38	0	60	76	174
24-27	0	0	0	92	82	174
28-31	0	0	0	459	0	459
32-35	0	0	0	0	0	0
36-39	0	0	0	103	0	103
40-43	0	0	0	0	0	0
44-47	0	0	0	0	0	0
48-51	0	0	0	441	0	441
52-55	0	0	0	0	0	0
56-59	0	0	0	0	0	0
60+	0	0	0	0	0	0
Total	90	152	59	1,431	362	2,094
% classes 1, 2, and 3 =		14	% classes 4 and 5 =		86	100
% pieces 3 - 19 feet =		18	% pieces 20+ feet =		82	100

[1]Weighted by forest survey unit acres. [2]Minimum size standards for down wood recorded on the sample down wood transects were as follows: minimum intersect diameter was 5 inches, minimum length was 8 feet, and minimum small-end diameter was 2 inches. [3]Includes data from forest survey plots in portions of the stands adjacent to the unit proposed for density management.

According to the forest survey data, 14% of the conifer down wood volume is in decay classes 1, 2, and 3, and 86% is in decay classes 4 and 5. About 18% of the down wood volume is in pieces from 3 to 19 feet long and 82% of the volume is in pieces 20 feet or longer. The total down wood volume is 2,094 cubic feet per acre.

Table SN-1 presents the weighted average number of conifer snags per acre by diameter and decay class, and the total conifer snag volume (cubic feet per acre), average height, basal area per acre, and quadratic mean diameter for Unit 1-1 and portions of the adjacent stands.

Table SN-1. Weighted average[1] number of conifer snags per acre by diameter and decay class, and the total conifer snag volume (cubic feet per acre), average height, basal area per acre, and quadratic mean DBH in Unit 1-1 in the Proposed Action in the environmental assessment for the Baker Creek Density Management Project and portions of the adjacent stands[2].

Diameter class	Number of snags per acre					
	Decay class 1	Decay class 2	Decay Class 3	Decay class 4	Decay class 5	Total
7-10	0.0	5.0	0.0	0.0	0.0	5.0
11-14	0.0	0.0	2.0	0.0	0.0	2.0
15-18	0.0	0.0	0.0	0.0	1.0	1.0
19-24	1.0	0.0	1.0	0.0	0.0	2.0
25-40	0.0	0.0	0.0	0.0	0.0	0.0
41+	0.0	0.0	0.0	0.0	0.0	0.0
Total	1.0	5.0	3.0	0.0	1.0	10.0
% class 1, 2, & 3 =		90	% class 4 & 5 =		10	100
% height 15-50 ft =		37	% height = 51 ft =		63	100
Total snag volume (cu ft/ac)	Average total snag height (ft)	Snag basal area/ac (sq ft)	Snags/ac	Snag QMD (in.)		
216	48	11.0	10.0	14		

[1]Weighted by forest survey unit acres. [2]Includes data from forest survey plots in portions of the stands adjacent to the unit proposed for density management.

There is a weighted average of about 10 snags per acre with an average diameter of 14 inches, an average height of about 48 feet, and a total weighted average volume of 216 cubic feet per acre. There is an estimated weighted average of 2,310 cubic feet per acre of coarse wood, with 91% of the volume coming from down wood and 9% of the volume coming from snags. About 90% of the snags are in decay classes 1, 2, and 3. About 10% of the total number of snags and are in decay classes 4 and 5. Approximately 37% of the snags are between 15 and 50 feet tall and 63% of the snags are 51 feet tall or taller.

Coarse wood data for Unit 1-2:

Table DW-2 presents the volume of conifer down wood in cubic feet per acre by diameter class, decay class, and piece length in Unit 1-2.

Table DW-2. Volume of conifer down wood[1] by diameter class, decay class, and piece length for Unit 1-2 in the Proposed Action in the environmental assessment for the Baker Creek Density Management Project.

Diameter Class	Cubic feet per acre					
	Decay class 1	Decay class 2	Decay class 3	Decay class 4	Decay class 5	Total
3-8	0	34	15	26	27	102
9-12	0	163	0	60	138	361
13-15	0	0	0	160	0	160
16-19	90	0	102	74	131	397
20-23	0	0	0	0	0	0
24-27	0	0	0	215	0	215
28-31	0	0	0	207	0	207
32-35	0	0	0	0	0	0
36-39	0	0	0	0	0	0
40-43	0	0	0	0	0	0
44-47	0	0	0	0	0	0
48-51	0	0	0	0	0	0
52-55	0	0	0	0	0	0
56-59	0	0	0	0	0	0
60+	0	0	0	0	0	0
Total	90	197	117	742	296	1,442
% classes 1, 2, and 3 =		28	% classes 4 and 5 =		72	100
% pieces 3 - 19 feet =		34	% pieces 20+ feet =		66	100

[1]Minimum size standards for down wood recorded on the sample down wood transects were as follows: minimum intersect diameter was 5 inches, minimum length was 8 feet, and minimum small-end diameter was 2 inches.

According to the forest survey data, 28% of the conifer down wood volume is in decay classes 1, 2, and 3, and 72% is in decay classes 4 and 5. About 34% of the down wood volume is in pieces from 3 to 19 feet long and 66% is in pieces 20 feet or longer. The total down wood volume is 1,442 cubic feet per acre.

Table SN-2 presents the number of conifer snags per acre by diameter and decay class, and the total conifer snag volume (cubic feet per acre), average height, basal area per acre, and quadratic mean diameter for Unit 1-2.

Table SN-2. Number of conifer snags per acre by diameter and decay class, and the total conifer snag volume (cubic feet per acre), average height, basal area per acre, and quadratic mean DBH in Unit 1-2 in the Proposed Action in the environmental assessment for the Baker Creek Density Management Project.

Diameter Class	Number of snags per acre					
	Decay class 1	Decay class 2	Decay class 3	Decay class 4	Decay class 5	Total
7-10	0.0	0.0	0.0	0.0	0.0	0.0
11-14	0.0	0.0	0.0	0.0	0.0	0.0
15-18	0.0	0.0	0.0	0.0	0.0	0.0
19-24	1.9	0.0	0.0	0.0	0.0	1.9
25-40	0.0	0.0	0.0	0.0	0.0	0.0
41+	0.0	0.0	0.0	0.0	0.0	0.0
Total	1.9	0.0	0.0	0.0	0.0	1.9
% class 1, 2, & 3 =		100	% class 4 & 5 =		0	100
% height 15-50 ft =		0	% height = 51 ft =		100	100
Total snag volume (cu ft/ac)	Average total snag height (ft)	Snag basal area/ac (sq ft)	Snags/ac	Snag QMD (in.)		
180	107	4.5	1.9	21		

There is an average of nearly 2 snags per acre with an average diameter of 21 inches, an average height of about 107 feet, and a total weighted average volume of 180 cubic feet per acre. There is an estimated *total* of 1,622 cubic feet per acre of coarse wood, with 89% of the volume coming from down wood and 11% of the volume coming from snags. All of the snags that occurred in the survey plots are in decay classes 1, 2, and 3. All of the snags that occurred in the survey plots are 51 feet tall or taller.

Coarse wood data for Unit 7-1:

Table DW-3 presents the volume of conifer down wood in cubic feet per acre by diameter class, decay class, and piece length in Unit 7-1 and portions of the adjacent stands.

Table DW-3. Volume of conifer down wood[1] by diameter class, decay class, and piece length for Unit 7-1 in the Proposed Action in the environmental assessment for the Baker Creek Density Management Project and portions of the adjacent stands[2].

Diameter Class	Cubic feet per acre					
	Decay class 1	Decay class 2	Decay class 3	Decay class 4	Decay class 5	Total
3-8	0	0	0	0	0	0
9-12	0	16	26	0	0	42
13-15	0	0	29	0	0	29
16-19	0	0	49	202	0	251
20-23	0	67	0	188	0	255
24-27	0	0	0	0	0	0
28-31	0	0	0	178	0	178
32-35	0	0	0	0	0	0
36-39	0	0	0	288	0	288
40-43	0	0	0	0	0	0
44-47	0	0	0	0	0	0
48-51	0	0	0	497	0	497
52-55	0	0	0	613	0	613
56-59	0	0	0	0	0	0
60+	0	0	0	0	0	0
Total	0	83	104	1,966	0	2,153
% classes 1, 2, and 3 =		9	% classes 4 and 5 =		91	100
% pieces 3 - 19 feet =		13	% pieces 20+ feet =		87	100

[1]Minimum size standards for down wood recorded on the sample down wood transects were as follows: minimum intersect diameter was 5 inches, minimum length was 8 feet, and minimum small-end diameter was 2 inches.
[2]Includes data from forest survey plots in portions of the stands adjacent to the unit proposed for density management.

According to the forest survey data, 9% of the conifer down wood volume is in decay classes 1, 2, and 3, and 91% is in decay classes 4 and 5. About 13% of the down wood volume is in pieces from 3 to 19 feet long and 87% is in pieces 20 feet or longer. The total down wood volume is 2,153 cubic feet per acre.

Table SN-3 presents the number of conifer snags per acre by diameter and decay class, and the total conifer snag volume (cubic feet per acre), average height, basal area per acre, and quadratic mean diameter for Unit 7-1 and portions of the adjacent stands.

Table SN-3. Number of conifer snags per acre by diameter and decay class, and the total conifer snag volume (cubic feet per acre), average height, basal area per acre, and quadratic mean DBH in Unit 7-1 in the Proposed Action in the environmental assessment for the Baker Creek Density Management Project and portions of the adjacent stands[1].

Diameter Class	Number of snags per acre					
	Decay class 1	Decay Class 2	Decay class 3	Decay class 4	Decay class 5	Total
7-10	0.0	0.0	0.0	0.0	0.0	0.0
11-14	0.0	2.1	0.0	0.0	0.0	2.1
15-18	0.0	1.2	0.0	0.0	0.0	1.2
19-24	0.0	2.1	0.0	0.0	0.0	2.1
25-40	0.0	0.0	0.0	0.0	0.0	0.0
41+	0.0	0.0	0.0	0.0	0.0	0.0
Total	0.0	5.4	0.0	0.0	0.0	5.4
% class 1, 2, & 3 =		100	% class 4 & 5 =		0	100
% height 15-50 ft =		0	% height = 51 ft =		100	100
Total snag volume (cu ft/ac)	Average total snag height (ft)	Snag basal area/ac (sq ft)	Snags/ac	Snag QMD (in.)		
284	76	9.1	5.4	18		

[1]Includes data from forest survey plots in portions of the stands adjacent to the unit proposed for density management.

There are an average of just over 5 snags per acre with an average diameter of about 18 inches, an average height of about 76 feet, and a total volume of 284 cubic feet per acre. There is a *total* of 2,437 cubic feet per acre of coarse wood in the stands, with 88% of the volume coming from down wood and 12% coming from snags. All of the snags that occurred in the survey plots were in decay classes 1, 2, and 3. All of the snags that occurred in the survey plots were 51 feet tall or taller.

Coarse wood data for Units 7-2 and 7-3:

Table DW-4 presents the volume of conifer down wood in cubic feet per acre by diameter class, decay class, and piece length in Units 7-2 and 7-3 and portions of the adjacent stands.

Table DW-4. Volume of conifer down wood[1] by diameter class, decay class, and piece length for Units 7-2 and 7-3 in the Proposed Action in the environmental assessment for the Baker Creek Density Management Project and portions of the adjacent stands[2].

Diameter Class	Cubic feet per acre					
	Decay class 1	Decay class 2	Decay class 3	Decay class 4	Decay class 5	Total
3-8	0	48	16	0	23	87
9-12	0	0	0	0	17	17
13-15	0	0	34	35	100	169
16-19	0	0	0	202	0	202
20-23	0	0	0	0	95	95
24-27	0	0	0	129	0	129
28-31	0	0	0	0	0	0
32-35	0	0	0	170	0	170
36-39	0	0	0	0	0	0
40-43	0	0	0	0	0	0
44-47	0	0	0	0	0	0
48-51	0	0	0	0	0	0
52-55	0	0	0	0	0	0
56-59	0	0	0	0	0	0
60+	0	0	0	0	0	0
Total	0	48	50	536	235	869
% classes 1, 2, and 3 =		11	% classes 4 and 5 =		89	100
% pieces 3 - 19 feet =		38	% pieces 20+ feet =		62	100

[1]Minimum size standards for down wood recorded on the sample down wood transects were as follows: minimum intersect diameter was 5 inches, minimum length was 8 feet, and minimum small-end diameter was 2 inches.
[2]Includes data from forest survey plots in portions of the stands adjacent to the unit proposed for density management.

According to the forest survey data, 11% of the conifer down wood volume is in decay classes 1, 2, and 3, and 89% is in decay classes 4 and 5. About 38% of the down wood volume is in pieces from 3 to 19 feet long and 62% is in pieces 20 feet or longer. The total down wood volume is 869 cubic feet per acre.

Table SN-4 presents the number of conifer snags per acre by diameter and decay class, and the total conifer snag volume (cubic feet per acre), average height, basal area per acre, and quadratic mean diameter for Units 7-2 and 7-3 and portions of the adjacent stands.

Table SN-4. Number of conifer snags per acre by diameter and decay class, and the total conifer snag volume (cubic feet per acre), average height, basal area per acre, and quadratic mean DBH in Units 7-2 and 7-3 in the Proposed Action in the environmental assessment for the Baker Creek Density Management Project and portions of the adjacent stands[1].

Diameter Class	Number of snags per acre					
	Decay class 1	Decay Class 2	Decay class 3	Decay class 4	Decay class 5	Total
7-10	0.0	5.5	0.0	0.0	0.0	5.5
11-14	0.0	0.0	0.0	0.0	0.0	0.0
15-18	0.0	0.0	0.0	0.0	0.0	0.0
19-24	0.0	0.0	0.0	0.0	0.0	0.0
25-40	0.0	0.0	0.0	0.0	0.0	0.0
41+	0.0	0.0	0.0	0.0	0.0	0.0
Total	0.0	5.5	0.0	0.0	0.0	5.5
% class 1, 2, & 3 =		100	% class 4 & 5 =		0	100
% height 15-50 ft =		100	% height = 51 ft =		0	100
Total snag volume (cu ft/ac)	Average total snag height (ft)	Snag basal area/ac (sq ft)	Snags/ac	Snag QMD (in.)		
20	44	1.5	5.5	7		

[1]Includes data from forest survey plots in portions of the stands adjacent to the unit proposed for density management.

There are an average of nearly 6 snags per acre with an average diameter of about 7 inches, an average height of about 44 feet, and a total volume of only 20 cubic feet per acre. There is a *total* of 889 cubic feet per acre of coarse wood in the stands, with 98% of the volume coming from down wood and 2% coming from snags. All of the snags that occurred in the survey plots were in decay classes 1, 2, and 3. All of the snags that occurred in the survey plots were between 15 and 51 feet tall.

Coarse wood data for Unit 25-1:

Table DW-5 presents the weighted average volume of conifer down wood in cubic feet per acre by diameter class, decay class, and piece length in Unit 25-1.

Table DW-5. Weighted average[1] volume of conifer down wood[2] by diameter class, decay class, and piece length for Unit 25-1 in the Proposed Action in the environmental assessment for the Baker Creek Density Management Project.

Diameter Class	Cubic feet per acre					
	Decay class 1	Decay class 2	Decay class 3	Decay class 4	Decay class 5	Total
3-8	5	13	29	10	2	59
9-12	14	37	48	42	0	141
13-15	52	0	34	84	0	170
16-19	17	0	56	75	0	148
20-23	0	0	156	147	0	303
24-27	0	0	273	58	0	331
28-31	0	0	52	50	0	102
32-35	0	0	0	0	0	0
36-39	0	0	114	0	0	114
40-43	0	0	0	126	0	126
44-47	0	0	0	0	0	0
48-51	0	0	0	0	0	0
52-55	0	0	0	0	0	0
56-59	0	0	0	0	0	0
60+	0	0	0	0	0	0
Total	88	50	762	592	2	1,494
% classes 1, 2, and 3 =		60	% classes 4 and 5 =		40	100
% pieces 3 - 19 feet =		37	% pieces 20+ feet =		63	100

[1]Weighted by forest survey unit acres. [2]Minimum size standards for down wood recorded on the sample down wood transects were as follows: minimum intersect diameter was 5 inches, minimum length was 8 feet, and minimum small-end diameter was 2 inches.

According to the forest survey data, 60% of the conifer down wood volume is in decay classes 1, 2, and 3, and 40% is in decay classes 4 and 5. About 37% of the down wood volume is in pieces from 3 to 19 feet long and 63% of the volume is in pieces 20 feet or longer. The total down wood volume is 1,494 cubic feet per acre.

Table SN-5 presents the weighted average number of conifer snags per acre by diameter and decay class, and the total conifer snag volume (cubic feet per acre), average height, basal area per acre, and quadratic mean diameter for Unit 25-1.

Table SN-5. Weighted average[1] number of conifer snags per acre by diameter and decay class, and the total conifer snag volume (cubic feet per acre), average height, basal area per acre, and quadratic mean DBH in Unit 25-1 in the Proposed Action in the environmental assessment for the Baker Creek Density Management Project.

Diameter Class	Number of snags per acre					
	Decay class 1	Decay class 2	Decay Class 3	Decay class 4	Decay class 5	Total
7-10	0.0	4.0	0.0	0.0	0.0	4.0
11-14	0.0	0.0	0.0	0.0	0.0	0.0
15-18	1.0	0.0	0.0	0.0	0.0	1.0
19-24	0.0	0.0	0.0	0.0	0.0	0.0
25-40	0.0	0.0	0.0	0.0	0.0	0.0
41+	0.0	0.0	0.0	0.0	0.0	0.0
Total	1.0	4.0	0.0	0.0	0.0	5.0
% class 1, 2, & 3 =		100	% class 4 & 5 =		0	100
% height 15-50 ft =		83	% height = 51 ft =		17	100
Total snag volume (cu ft/ac)	Average total snag height (ft)	Snag basal area/ac (sq ft)	Snags/ac	Snag QMD (in.)		
60	38	3.1	5.0	11		

[1]Weighted by forest survey unit acres.

There is a weighted average of about 5 snags per acre with an average diameter of 11 inches, an average height of about 38 feet, and a total weighted average volume of 60 cubic feet per acre. There is an estimated weighted average of 1,554 cubic feet per acre of coarse wood, with 96% of the volume coming from down wood and 4% coming from snags. All of the snags that occurred in the survey plots were in decay classes 1, 2, and 3. Approximately 83% of the snags are between 15 and 50 feet tall and 17% of the snags are 51 feet tall or taller.

Coarse wood data for Unit 29-1:

Table DW-6 presents the volume of conifer down wood in cubic feet per acre by diameter class, decay class, and piece length in Unit 29-1 and portions of the adjacent stand.

Table DW-6. Volume of conifer down wood[1] by diameter class, decay class, and piece length for Unit 29-1 in the Proposed Action in the environmental assessment for the Baker Creek Density Management Project and a portion of the adjacent stand[2].

Diameter Class	Cubic feet per acre					
	Decay class 1	Decay class 2	Decay class 3	Decay class 4	Decay Class 5	Total
3-8	14	8	0	0	0	22
9-12	75	0	89	30	28	222
13-15	43	0	153	0	0	196
16-19	66	0	114	83	0	263
20-23	0	0	0	0	0	0
24-27	0	0	0	0	0	0
28-31	0	0	897	0	0	897
32-35	0	0	0	0	0	0
36-39	0	0	0	0	0	0
40-43	0	0	0	0	0	0
44-47	0	0	0	0	0	0
48-51	0	0	0	0	0	0
52-55	0	0	0	0	0	0
56-59	0	0	0	0	0	0
60+	0	0	0	0	0	0
Total	198	8	1,253	113	28	1,600
% classes 1, 2, and 3 =		91	% classes 4 and 5 =		9	100
% pieces 3 - 19 feet =		3	% pieces 20+ feet =		97	100

[1]Minimum size standards for down wood recorded on the sample down wood transects were as follows: minimum intersect diameter was 5 inches, minimum length was 8 feet, and minimum small-end diameter was 2 inches.
[2]Includes data from forest survey plots in a portion of the stand adjacent to the unit proposed for density management.

According to the forest survey data, 91% of the conifer down wood volume is in decay classes 1, 2, and 3, and 9% is in decay classes 4 and 5. About 3% of the down wood volume is in pieces from 3 to 19 feet long and 97% is in pieces 20 feet or longer. The total down wood volume is 1,600 cubic feet per acre.

Table SN-6 presents the number of conifer snags per acre by diameter and decay class, and the total conifer snag volume (cubic feet per acre), average height, basal area per acre, and quadratic mean diameter for Unit 29-1 and a portion of the adjacent stand.

Table SN-6. Number of conifer snags per acre by diameter and decay class, and the total conifer snag volume (cubic feet per acre), average height, basal area per acre, and quadratic mean DBH in Unit 29-1 in the Proposed Action in the environmental assessment for the Baker Creek Density Management Project and a portion of the adjacent stand[1].

Diameter Class	Number of snags per acre					
	Decay class 1	Decay Class 2	Decay class 3	Decay class 4	Decay class 5	Total
7-10	6.1	12.5	0.0	0.0	0.0	18.6
11-14	0.0	0.0	0.0	0.0	0.0	0.0
15-18	2.7	0.0	0.0	0.0	0.0	2.7
19-24	0.0	0.0	0.0	0.0	0.0	0.0
25-40	0.0	0.0	0.0	0.0	0.0	0.0
41+	0.0	0.0	0.0	0.0	0.0	0.0
Total	8.8	12.5	0.0	0.0	0.0	21.3
% class 1, 2, & 3 =		100	% class 4 & 5 =		0	100
% height 15-50 ft =		59	% height = 51 ft =		41	100
Total snag volume (cu ft/ac)	Average total snag height (ft)	Snag basal area/ac (sq ft)	Snags/ac	Snag QMD (in.)		
209	39	10.0	21.3	9		

[1]Includes data from forest survey plots in portions of the stands adjacent to the unit proposed for density management.

There is an average of just over 21 snags per acre with an average diameter of about 9 inches, an average height of about 39 feet, and a total volume of 209 cubic feet per acre. There is a *total* of 1,809 cubic feet per acre of coarse wood in the stand, with 88% of the volume coming from down wood and 12% coming from snags. All of the snags that occurred in the survey plots were in decay classes 1, 2, and 3. About 59% of the snags are between 15 and 51 feet tall, and 41% of the snags are 51 feet tall or taller.

Coarse wood data for Unit 31-1:

Table DW-7 presents the volume of conifer down wood in cubic feet per acre by diameter class, decay class, and piece length in Unit 31-1.

Table DW-7. Volume of conifer down wood[1] by diameter class, decay class, and piece length for Unit 31-1 in the Proposed Action in the environmental assessment for the Baker Creek Density Management Project.

Diameter Class	Cubic feet per acre					
	Decay class 1	Decay class 2	Decay class 3	Decay class 4	Decay Class 5	Total
3-8	0	12	36	38	12	98
9-12	0	23	67	0	67	157
13-15	0	0	0	0	0	0
16-19	0	0	0	0	93	93
20-23	0	0	0	0	0	0
24-27	0	0	0	0	0	0
28-31	0	0	0	363	0	363
32-35	0	0	0	0	0	0
36-39	0	0	0	0	0	0
40-43	0	0	0	0	0	0
44-47	0	0	0	0	0	0
48-51	0	0	0	0	0	0
52-55	0	0	0	0	0	0
56-59	0	0	0	0	0	0
60+	0	0	0	0	0	0
Total	0	35	103	401	172	711
% classes 1, 2, and 3 =		19	% classes 4 and 5 =		81	100
% pieces 3 – 19 feet =		11	% pieces 20+ feet =		89	100

[1]Minimum size standards for down wood recorded on the sample down wood transects were as follows: minimum intersect diameter was 5 inches, minimum length was 8 feet, and minimum small-end diameter was 2 inches.

According to the forest survey data, 19% of the conifer down wood volume is in decay classes 1, 2, and 3, and 81% is in decay classes 4 and 5. About 11% of the down wood volume is in pieces from 3 to 19 feet long and 89% is in pieces 20 feet or longer. The total down wood volume is 711 cubic feet per acre.

Table SN-7 presents the number of conifer snags per acre by diameter and decay class, and the total conifer snag volume (cubic feet per acre), average height, basal area per acre, and quadratic mean diameter for Unit 31-1.

Table SN-7. Number of conifer snags per acre by diameter and decay class, and the total conifer snag volume (cubic feet per acre), average height, basal area per acre, and quadratic mean DBH in Unit 31-1 in the Proposed Action in the environmental assessment for the Baker Creek Density Management Project.

Diameter Class	Number of snags per acre					
	Decay class 1	Decay Class 2	Decay class 3	Decay class 4	Decay class 5	Total
7-10	0.0	6.2	15.2	0.0	0.0	21.4
11-14	3.1	0.0	0.0	0.0	0.0	3.1
15-18	0.0	0.0	2.4	0.0	0.0	2.4
19-24	0.0	0.0	0.0	0.0	1.2	1.2
25-40	0.0	0.0	0.0	0.5	0.0	0.5
41+	0.0	0.0	0.0	0.0	0.0	0.0
Total	3.1	6.2	17.6	0.5	1.2	28.6
% class 1, 2, & 3 =		94	% class 4 & 5 =		6	100
% height 15-50 ft =		67	% height = 51 ft =		33	100
Total snag volume (cu ft/ac)	Average total snag height (ft)	Snag basal area/ac (sq ft)	Snags/ac	Snag QMD (in.)		
438	37	26.9	28.6	13		

There is an average of almost 29 snags per acre with an average diameter of about 13 inches, an average height of about 37 feet, and a total volume of 438 cubic feet per acre. There is a *total* of 1,149 cubic feet per acre of coarse wood in the stand, with 62% of the volume coming from down wood and 38% coming from snags. About 94% of the snags that occurred in the survey plots were in decay classes 1, 2, and 3, and about 6% of the snags were in decay classes 4 and 5. About 67% of the snags are between 15 and 51 feet tall, and 33% of the snags are 51 feet tall or taller.

Coarse wood data for Unit 33-1:

Table DW-8 presents the volume of conifer down wood in cubic feet per acre by diameter class, decay class, and piece length in Unit 31-1.

Table DW-8. Volume of conifer down wood[1] by diameter class, decay class, and piece length for Unit 33-1 in the Proposed Action in the environmental assessment for the Baker Creek Density Management Project.

Diameter Class	Cubic feet per acre					
	Decay class 1	Decay class 2	Decay class 3	Decay class 4	Decay Class 5	Total
3-8	26	36	24	16	0	102
9-12	0	0	113	0	0	113
13-15	53	0	0	233	0	286
16-19	0	0	100	0	0	100
20-23	0	0	0	0	0	0
24-27	0	0	217	0	0	217
28-31	0	0	335	0	0	335
32-35	0	0	0	0	0	0
36-39	0	0	0	0	0	0
40-43	0	0	0	0	0	0
44-47	0	0	0	0	0	0
48-51	0	0	0	0	0	0
52-55	0	0	0	0	0	0
56-59	0	0	0	0	0	0
60+	0	0	0	0	0	0
Total	79	36	789	249	0	1,153
% classes 1, 2, and 3 =		78	% classes 4 and 5 =		22	100
% pieces 3 – 19 feet =		22	% pieces 20+ feet =		78	100

[1]Minimum size standards for down wood recorded on the sample down wood transects were as follows: minimum intersect diameter was 5 inches, minimum length was 8 feet, and minimum small-end diameter was 2 inches.

According to the forest survey data, 78% of the conifer down wood volume is in decay classes 1, 2, and 3, and 22% is in decay classes 4 and 5. About 22% of the down wood volume is in pieces from 3 to 19 feet long and 78% is in pieces 20 feet or longer. The total down wood volume is 1,153 cubic feet per acre.

Table SN-8 presents the number of conifer snags per acre by diameter and decay class, and the total conifer snag volume (cubic feet per acre), average height, basal area per acre, and quadratic mean diameter for Unit 33-1.

Table SN-8. Number of conifer snags per acre by diameter and decay class, and the total conifer snag volume (cubic feet per acre), average height, basal area per acre, and quadratic mean DBH in Unit 33-1 in the Proposed Action in the environmental assessment for the Baker Creek Density Management Project.

Diameter Class	Number of snags per acre					
	Decay class 1	Decay Class 2	Decay class 3	Decay class 4	Decay class 5	Total
7-10	45.9	10.0	0.0	0.0	0.0	55.9
11-14	0.0	0.0	0.0	0.0	0.0	0.0
15-18	7.5	0.0	0.0	0.0	0.0	7.5
19-24	0.0	0.0	0.0	0.0	0.0	0.0
25-40	0.0	0.0	0.0	1.0	0.0	1.0
41+	0.0	0.0	0.0	0.4	0.0	0.4
Total	53.4	10.0	0.0	1.4	0.0	64.8
% class 1, 2, & 3 =		98	% class 4 & 5 =		2	100
% height 15-50 ft =		42	% height = 51 ft =		58	100
Total snag volume (cu ft/ac)	Average total snag height (ft)	Snag basal area/ac (sq ft)	Snags/ac	Snag QMD (in.)		
779	63	40.8	64.8	11		

There is an average of nearly 65 snags per acre with an average diameter of about 11 inches, an average height of about 63 feet, and a total volume of 779 cubic feet per acre. There is a *total* of 1,932 cubic feet per acre of coarse wood in the stand, with 60% of the volume coming from down wood and 40% coming from snags. About 98% of the snags that occurred in the survey plots were in decay classes 1, 2, and 3, and about 2% of the snags were in decay classes 4 and 5. About 42% of the snags are between 15 and 51 feet tall, and 58% of the snags are 51 feet tall or taller.

Coarse wood data for Units 35-1 and 35-2:

Table DW-9 presents the volume of conifer down wood in cubic feet per acre by diameter class, decay class, and piece length in Units 35-1 and 35-2 and a portion of the adjacent stand.

Table DW-9. Volume of conifer down wood[1] by diameter class, decay class, and piece length for Units 35-1 and 35-2 in the Proposed Action in the environmental assessment for the Baker Creek Density Management Project and a portion of the adjacent stand[2].

Diameter Class	Cubic feet per acre					
	Decay class 1	Decay Class 2	Decay class 3	Decay class 4	Decay Class 5	Total
3-8	18	25	35	17	13	108
9-12	76	47	52	104	49	328
13-15	140	77	22	86	80	405
16-19	74	34	45	105	126	384
20-23	39	43	77	194	67	420
24-27	0	0	60	621	0	681
28-31	0	0	0	593	0	593
32-35	0	0	0	341	124	465
36-39	0	0	0	224	176	400
40-43	0	0	0	444	277	721
44-47	0	0	0	341	0	341
48-51	0	0	0	0	0	0
52-55	0	0	0	0	0	0
56-59	0	0	0	0	0	0
60+	0	0	0	0	0	0
Total	347	226	291	3,070	912	4,846
% classes 1, 2, and 3 =		18	% classes 4 and 5 =		82	100
% pieces 3 - 19 feet =		24	% pieces 20+ feet =		76	100

[1]Minimum size standards for down wood recorded on the sample down wood transects were as follows: minimum intersect diameter was 5 inches, minimum length was 8 feet, and minimum small-end diameter was 2 inches.
[2]Includes data from forest survey plots in a portion of the stand adjacent to the unit proposed for density management.

According to the forest survey data, 18% of the conifer down wood volume is in decay classes 1, 2, and 3, and 82% is in decay classes 4 and 5. About 24% of the down wood volume is in pieces from 3 to 19 feet long and 76% of the volume is in pieces 20 feet or longer. The total down wood volume is 4,846 cubic feet per acre.

Table SN-9 presents the number of conifer snags per acre by diameter and decay class, and the total conifer snag volume (cubic feet per acre), average height, basal area per acre, and quadratic mean diameter for Units 35-1 and 35-2 and a portion of the adjacent stand.

Table SN-9. Number of conifer snags per acre by diameter and decay class, and the total conifer snag volume (cubic feet per acre), average height, basal area per acre, and quadratic mean DBH in Units 35-1 and 35-2 in the Proposed Action in the environmental assessment for the Baker Creek Density Management Project and a portion of the adjacent stand[1].

Diameter class	Number of snags per acre					
	Decay class 1	Decay class 2	Decay class 3	Decay class 4	Decay class 5	Total
7-10	4.7	0.0	0.0	0.0	0.0	4.7
11-14	0.0	0.0	0.0	0.0	0.0	0.0
15-18	0.0	0.0	0.0	0.0	0.0	0.0
19-24	0.0	0.0	0.0	0.0	0.0	0.0
25-40	0.0	0.0	0.0	0.0	0.0	0.0
41+	0.0	0.0	0.0	0.4	0.0	0.4
Total	4.7	0.0	0.0	0.4	0.0	5.2
% class 1, 2, & 3 =		92	% class 4 & 5 =		8	100
% height 15-50 ft =		6	% height = 51 ft =		94	100
Total snag volume (cu ft/ac)	Average total snag height (ft)	Snag basal area/ac (sq ft)	Snags/ac	Snag QMD (in.)		
174	84	8.4	5.2	17		

[1]Includes data from forest survey plots in a portion of the stand adjacent to the unit proposed for density management.

There are just over 5 snags per acre with an average diameter of 17 inches, an average height of about 84 feet, and a total volume of 174 cubic feet per acre. There is a *total* of 5,020 cubic feet per acre of coarse wood, with 97% of the volume coming from down wood and 3% of the volume coming from snags. About 92% of the snags are in decay classes 1, 2, and 3. About 8% of the total number of snags and are in decay classes 4 and 5. Approximately 6% of the snags are between 15 and 50 feet tall and 94% of the snags are 51 feet tall or taller.

G. Stand development prognosis without density management thinning (the "No Action" alternative in the environmental assessment for this project):

According to stand development projections using the ORGANON growth and yield model (Hann et al. 1997), the relative density index of the stands without thinning will continue to increase to very high levels over the next 20 years. Development toward late-successional forest conditions in these stands is expected to continue to slow unless some form of disturbance occurs that creates openings in the stands to permit accelerated growth of some overstory trees and provides an opportunity for understory trees, shrubs, and herbs to grow. As the level of competition among the trees remains high, crown development (live crown ratio, crown expansion, and branch growth) will decrease, diameter growth rate can be expected to decline, competition-related mortality will increase resulting in coarse woody debris additions mainly from the smaller-diameter trees that slowly die from suppression (except in areas where *P. weirii* infection has resulted in windthrow of larger-sized Douglas-fir trees), and understory development will be limited. In addition, the stands are expected to remain relative unstable because of susceptibility to wind and snow damage as indicated by height:diameter ratios over 80 (Wonn and O'Hara 2001). Based on growth projections by ORGANON (Hann et al. 1997), 89% of the units will have height:diameter ratios of 82 or greater and 56% of the units will have height:diameter ratios of 93 or more after 20 years without thinning when calculated from the quadratic mean diameter for the Douglas-fir stand component and the height of the 40 largest trees per acre. The number of trees per acre, amount of basal area per acre, quadratic mean diameter, relative density index, and mean crown ratio for the stands at the present time and for 20 years from now without thinning as projected by ORGANON (Hann et al. 1997) are compared in Table NT-1.

Table NT-1. Comparison of trees per acre, basal area per acre, quadratic mean diameter, relative density index, and mean crown ratio for stands in the Proposed Action in the environmental assessment for the Baker Creek Density Management Project at the present time and for 20 years from present without thinning as projected by ORGANON (Hann et al. 1997).

	Current condition						Projected condition 20 years from present					
Unit	Age[1] (yrs)	TPA[2]	BA[3] (sq ft)	QMD (in)[4]	RDI[5]	CR[6]	Age[1] (yrs)	TPA[2]	BA[3] (sq ft)	QMD (in)[4]	RDI[5]	CR[6]
1-1	47	251.6	283.1	14.4	0.865	0.369	67	201.5	355.9	18.0	0.994	0.294
1-2	57	194.9	290.1	16.5	0.838	0.384	77	168.0	365.3	20.0	0.979	0.301
7-1	50	142.4	192.5	15.7	0.567	0.310	64	136.1	280.0	19.4	0.759	0.209
7-2, 3	34	232.0	160.4	11.3	0.539	0.473	54	212.0	272.1	15.3	0.809	0.304
25-1	41	331.5	236.1	11.4	0.789	0.456	61	264.8	331.3	15.1	0.991	0.316
25-1w[7]	41	331.5	236.1	11.4	0.789	0.456	61	264.8	331.3	15.1	0.991	0.316
29-1	46	261.7	192.0	11.6	0.638	0.315	66	239.3	259.5	14.1	0.789	0.243
31-1	66	222.0	238.6	14.0	0.735	0.441	86	196.2	338.4	17.8	0.950	0.340
33-1	52	310.5	288.3	13.0	0.914	0.253	72	247.0	339.6	15.9	0.997	0.216
35-1, 2	53	261.2	284.1	14.1	0.873	0.417	73	206.8	354.2	17.7	0.995	0.328

[1]Total stand age. [2]Number of trees per acre. [3]Basal area per acre. [4]Quadratic mean diameter. [5]Proportion of maximum Stand Density Index (Reineke 1933). [6]Live crown ratio. [7]Six wide thinning patches (approximately 0.12 acres each) within the Riparian Reserves as part of the AMA learning objectives.

H. Silvicultural objectives:

In the areas proposed for density management, the objectives of the treatments contained in this prescription are to: (1) accelerate the development of some late-successional forest structural features, including large trees (some with large limbs, and long and wide crowns), gaps in the canopy, snags and down logs, various levels of overstory tree densities, and various levels of understory development; (2) enhance the overall level of diversity in the area; (3) develop stand windfirmness and stability (indicated by the height:diameter ratio) so that future density management treatments could continue this process, if such treatments were determined to be necessary at that time; (4) reduce the impact and spread of *P. weirii* root rot; and (5) supply timber to local mills. Proposed treatments within the Riparian Reserves are expected to be meet or at least not prevent the attainment of the Aquatic Conservation Strategy objectives and provide habitat for sensitive terrestrial species (see Table RR-1). With the exception of the six wide thinning patches in the Riparian Reserve of an intermittent, non-fish-bearing stream in Unit 25-1 and the patch-cut *P. weirii* root disease infection centers (mostly in Units 1-1, 7-1, 25-1, and 35-2), a moderate level of thinning is suggested in the relatively disease-free areas because of the relatively high stand density levels and because of the adjacency to portions of the stands with relatively high levels of *P.weirii* in some units (especially Units 1-1 and 25-1).

I. Density management thinning and the anticipated effects on stand development (anticipated impacts of the Proposed Action):

Thinning these stands, including the Riparian Reserves outside of the "no-harvest" buffers, in a variable-spaced manner will best accomplish the management objectives for the applicable land-use allocations (encourage development of some late-successional stand features and provide timber to local mills in the AMA, and encourage development of some late-successional stand features and help to meet the objectives of the Aquatic Conservation Strategy in the Riparian Reserves). Retention of the larger-sized (dominant and co-dominant) trees will be emphasized. In addition, one of the AMA learning objectives included in this proposed project is determining if *individual* large-diameter trees can be developed by relatively wide thinning in selected areas (six patches of approximately 0.12 acre each) within the Riparian Reserve, including a portion of the 50-foot "no-harvest" buffer, along an intermittent, non-fish-bearing stream. These Riparian Reserve wide thinning patches are located in Unit 25-1. The overstory density in each of these patches will be reduced to about 17 trees per acre (approximately 30 square feet of basal area per acre) and underplanted with a mixture of shade-tolerant conifers (primarily western hemlock, grand fir, and western redcedar).

The average pre-treatment and the recommended post-treatment stand characteristics along with the expected volume per acre to be removed based on stand projections using the ORGANON growth and yield model (Hann et al. 1997) are shown in Table TR-1. The percentage of the basal area per acre and the trees per acre to be removed for the proposed density management thinning units are shown in Table TR-2.

Thinning to the above-recommended densities is expected to put the stands on a trajectory toward development of some late-seral forest conditions without adversely affecting short-term habitat quality, and yield a weighted average of approximately 9,705,000 board feet (1,890,000 cubic feet) of timber over the 647-acre treatment area (average of about 15,000 board feet or 2,921 cubic feet per acre). The number of trees per acre, amount of basal area per acre, quadratic mean diameter, relative density index, and live crown ratio for the stands after 20 years with and without thinning as projected by ORGANON (Hann et al. 1997) are compared in Table TR-3. Immediately after thinning, the overstory canopy closure is not expected to fall below an average of 40% in the relatively root-disease-free portions of most units.

Table TR-1. Average pre-treatment and recommended post-treatment stand characteristics immediately after thinning as proposed for stands in the Proposed Action in the environmental assessment for the Baker Creek Density Management Project.

Unit	Age[1] (yrs)	Pre-treatment stand characteristics					Recommended post-treatment stand characteristics immediately after thinning				
		TPA[2]	BA[3] (sq ft)	QMD (in)[4]	RDI[5]	CR[6]	TPA[2]	BA[3] (sq ft)	QMD (in)[4]	RDI[5]	CR[6]
1-1	47	251.6	283.1	14.4	0.865	0.369	65.1	150.0	20.6	0.398	0.465
1-2	57	194.9	290.1	16.5	0.838	0.384	58.1	160.0	22.5	0.409	0.503
7-1	50	142.4	192.5	15.7	0.567	0.310	65.2	130.0	19.1	0.355	0.361
7-2, 3	34	232.0	160.4	11.3	0.539	0.473	109.0	110.0	13.6	0.343	0.537
25-1	41	331.5	236.1	11.4	0.789	0.456	106.6	120.0	14.4	0.366	0.519
25-1w[7]	41	331.5	236.1	11.4	0.789	0.456	17.1	30.3	18.0	0.085	0.614
29-1	46	261.7	192.0	11.6	0.638	0.315	102.6	120.0	14.6	0.364	0.354
31-1	66	222.0	238.6	14.0	0.735	0.441	68.1	140.0	19.4	0.380	0.416
33-1	52	310.5	288.3	13.0	0.914	0.253	78.0	150.0	18.8	0.412	0.334
35-1, 2	53	261.2	284.1	14.1	0.873	0.417	70.7	150.0	19.7	0.404	0.510

[1]Total stand age. [2]Number of trees per acre. [3]Basal area per acre. [4]Quadratic mean diameter. [5]Proportion of maximum Stand Density Index (Reineke 1933). [6]Live crown ratio. [7]Six wide thinning patches (approximately 0.12 acres each) within the Riparian Reserves as part of the AMA learning objectives.

Table TR-2. Percentage of basal area and trees per acre removed when thinned as proposed in the Proposed Action in the environmental assessment for the Baker Creek Density Management Project.

Unit	Trees/ac				Basal area (sq ft/ac)			
	Before Thinning	After thinning	Difference	Percent removed	Before thinning	After thinning	Difference	Percent removed
1-1	251.6	65.1	-186.5	-74	283.1	150.0	-133.1	-47
1-2	194.9	58.1	-136.8	-70	290.1	160.0	-130.1	-45
7-1	142.4	65.2	-77.2	-54	192.5	130.0	-62.5	-32
7-2, 3	232.0	109.0	-123.0	-53	160.4	110.0	-50.4	-31
25-1	331.5	106.6	-224.9	-68	236.1	120.0	-116.1	-49
25-1w[1]	331.5	17.1	-314.4	-95	236.1	30.3	-205.8	-87
29-1	261.7	102.6	-159.1	-61	192.0	120.0	-72.0	-38
31-1	222.0	68.1	-153.9	-69	238.6	140.0	-98.6	-41
33-1	310.5	78.0	-232.5	-75	288.3	150.0	-138.3	-48
35-1, 2	261.2	70.7	-190.5	-73	284.1	150.0	-134.1	-47

[1]Six wide thinning patches (approximately 0.12 acres each) within the Riparian Reserves as part of the AMA learning objectives.

Table TR-3. Comparison of trees per acre, basal area per acre, quadratic mean diameter, relative density index, and live crown ratio for the stands after 20 years with and without thinning as projected by ORGANON (Hann et al. 1997) for the units in the Proposed Action in the environmental assessment for the Baker Creek Density Management Project.

		Post-treatment characteristics 20 years after thinning					Stand characteristics after 20 years without thinning				
Unit	Age[1] (yrs)	TPA[2]	BA[3] (sq ft)	QMD (in)[4]	RDI[5]	CR[6]	TPA[2]	BA[3] (sq ft)	QMD (in)[4]	RDI[5]	CR[6]
1-1	67	65.0	232.5	25.6	0.565	0.385	201.5	355.9	18.0	0.994	0.294
1-2	77	58.0	241.2	27.6	0.569	0.421	168.0	365.3	20.0	0.979	0.301
7-1	70	65.1	215.3	24.6	0.531	0.296	136.1	280.0	19.4	0.759	0.209
7-2, 3	54	107.9	220.6	19.4	0.599	0.379	212.0	272.1	15.3	0.809	0.304
25-1	61	106.2	231.7	20.0	0.621	0.402	264.8	331.3	15.1	0.991	0.316
25-1w[7]	61	17.1	68.6	27.1	0.163	0.713	264.8	331.3	15.1	0.991	0.316
29-1	66	100.8	185.8	18.4	0.515	0.315	239.3	259.5	14.1	0.789	0.243
31-1	86	68.1	229.7	24.9	0.565	0.362	196.2	338.4	17.8	0.950	0.340
33-1	72	77.9	216.0	22.6	0.552	0.285	247.0	339.6	15.9	0.997	0.216
35-1, 2	73	70.6	233.9	24.6	0.577	0.425	206.8	354.2	17.7	0.995	0.328

[1]Total stand age. [2]Number of trees per acre. [3]Basal area per acre. [4]Quadratic mean diameter. [5]Proportion of maximum Stand Density Index (Reineke 1933). [6]Live crown ratio. [7]Six wide thinning patches (approximately 0.12 acres each) within the Riparian Reserves as part of the AMA learning objectives.

Several levels of density management were evaluated for the stands proposed for treatment using the ORGANON growth and yield computer simulation model (Hann et al. 1997). Based on the results from the stand growth projections considered together with the initial stand conditions (relative density index, basal area per acre, trees per acre, live crown ratio, and height:diameter ratio), residual trees per acre and basal area per acre, the percentage of trees per acre and basal area per acre removed, crown ratios of the potential leave trees, and the radial growth rates measured and estimated, the appropriate level of thinning for each unit was prescribed to accomplish the silvicultural objectives for the units. On the average, the recommended levels of thinning should maintain stand growth and site occupancy (site occupancy, however, would not be maintained in the six 0.12-acre wide thinning patches located in the Riparian Reserves in Unit 25-1 that will be thinned to approximately 17 trees per acre or in the relatively open areas around *P. weirii* infection centers), promote stand stability (indicated by the height:diameter ratio), and result in a greater level of understory development than would occur without thinning. Bailey and Tappeiner (1998) compared the effects of thinning in 40- to 100-year-old Douglas-fir stands in the Coast and Cascade ranges of western Oregon. Thinned stands had higher tree seedling density and frequency, understory tree density, tall shrub density and frequency, and low shrub cover (%) than unthinned stands. Thinned stands were also similar to old-growth stands in tree seedling density and frequency, understory tree density, and density of tall shrubs. They concluded that the findings in their study are strong evidence that thinning, even when done primarily to manage overstory/crop tree spacing (thinnings done for commercial wood production), promotes tree regeneration, shrub growth, and multi-storied stand development. They further concluded treatments designed to purposely incorporate retention of legacy structures such as large remnant trees, snags, and down wood, and/or retention of overstory hardwoods would further accelerate the development of old-growth characteristics.

Because of the very high densities in many of the stands, heavier thinnings to try achieve a more rapid diameter growth and crown development, and a greater degree of understory development were not recommended at this time (except in the six 0.12-acre wide thinning patches in the Riparian Reserves of Unit 25-1). Lighter thinnings would not likely be sufficient to accomplish the silvicultural goals for the units. Based on the increase in relative density index over time, these stands should be evaluated for additional thinning treatments 20 years or so after thinning to further the development of older-forest stand characteristics.

As a result of thinning, the average stand diameters are expected to increase, crown ratios and limb development of the residual trees should increase, growth of understory trees, shrubs, and herbs should be stimulated, windfirmness and stability (indicated by the height:diameter ratio) of the residual trees would increase, and mortality of the smaller-sized trees should decrease (little competition-related mortality is expected for at least the next 20 years following thinning). By thinning in a variable-spaced manner, some trees would be given more room to grow and others would be given less. This should increase overstory canopy heterogeneity and result in a more uneven pattern of understory development. The larger-sized trees would result in higher quality down logs and snags as the trees eventually die or are converted to snags or down logs through planned management actions.

Table TR-4 compares the height:diameter ratios of the thinned and unthinned stands at the present time and after 20 years when calculated from the quadratic mean diameter for the Douglas-fir stand component and the height of the 40 largest trees per acre as predicted by ORGANON (Hann et al. 1997). At the present time, nearly 89% of the units have height:diameter ratios of 85 or greater, and nearly 78% of the units have height:diameter ratios of 90 or more. After 20 years, about 89% of the units are predicted to have height:diameter ratios of 82 or greater, and nearly 56% of the units are predicted to have height:diameter ratios of 93 or more. In contrast, the height:diameter ratios of the thinned stands are expected to be less than 80 and are predicted to remain less than 80 for at least 20 years after thinning.

Table TR-5 compares the predicted increase in Douglas-fir quadratic mean diameter and mean tree volume (cubic feet) as a result of density management thinning after 20 years. The increase in quadratic mean diameter ranges from 27 to 42% (27 to 79% including the six 0.12-acre wide thinning patches in Unit 25-1). The increase in mean tree volume, however, ranges from 92 to 166% (92 to 403% including the wide thinning patches in Unit 25-1).

Table TR-4. Comparison of the height:diameter ratios of thinned and unthinned stands at the present time and after 20 years when calculated from the quadratic mean diameter for the Douglas-fir stand component and the height of the 40 largest trees per acre as predicted by ORGANON (Hann et al. 1997) for the units in the Proposed Action in the environmental assessment for the Baker Creek Density Management Project.

Unit	Unthinned		Thinned	
	Present time	20 years from present	Immediately after thinning	20 years after thinning
1-1	99	96	70	68
1-2	85	82	67	65
7-1	75	76	64	62
7-2, 3	94	96	78	76
25-1	97	96	78	74
25-1w[1]	97	96	62	55
29-1	95	99	78	77
31-1	102	88	74	63
33-1	96	93	75	74
35-1, 2	90	87	66	64

[7]Six wide thinning patches (approximately 0.12 acres each) within the Riparian Reserves as part of the AMA learning objectives.

Table TR-5. Comparison of quadratic mean diameter and mean tree volume for the Douglas-fir component in the stands after 20 years with and without thinning as projected by ORGANON (Hann et al. 1997) for the units in the Proposed Action in the environmental assessment for the Baker Creek Density Management Project.

Unit	Quadratic mean diameter (in)				Mean tree volume (cubic feet)[2]			
	Thinned	Unthinned	Difference	Percent increase	Thinned	Unthinned	Difference	Percent increase
1-1	25.6	18.0	7.6	42	163.9	61.7	102.2	166
1-2	27.6	20.0	7.6	38	208.2	89.6	118.6	132
7-1	24.6	19.4	5.2	27	153.1	70.1	83.0	118
7-2, 3	19.4	15.3	4.1	27	70.1	35.3	34.8	99
25-1	20.0	15.1	4.9	32	89.6	35.3	54.3	154
25-1w[1]	27.1	15.1	12.0	79	177.5	35.3	142.2	403
29-1	18.4	14.1	4.3	30	61.7	32.2	29.5	92
31-1	24.9	17.8	7.1	40	153.1	61.7	91.4	148
33-1	22.6	15.9	6.7	42	113.5	51.3	62.2	121
35-1, 2	24.6	17.7	6.9	39	153.1	61.7	91.4	148

[1]Six wide thinning patches (approximately 0.12 acres each) within the Riparian Reserves as part of the AMA learning objectives. [2]Cubic-foot volume rounded to the nearest one cubic one foot based on quadratic mean diameter rounded to the nearest whole inch.

J. Anticipated effects on stand development and the attainment of the Aquatic Conservation Strategy objectives from density management thinning within Riparian Reserves:

Riparian Reserves, as specified in the RMP, include an area which is one site-potential tree height (site-potential tree heights vary from 180 to 220 feet for the units planned for treatment—see Table G-1) on each side of streams that do not contain fish (mostly intermittent streams) and two site-potential tree heights in width on each side of fish-bearing streams and water bodies.

The growth rates (especially diameter growth rates) of Douglas-fir trees within these densely stocked stands generally are slower, the length of the live crowns are shorter, the widths of the crowns are narrower, and the length and diameter of the limbs are smaller than those growing under less crowded conditions. The understory development in these dense stands is also reduced. Understory development will continue to be limited as the overstory density increases. In general, stands which are more densely stocked have very little, if any conifer regeneration in the understory. The few conifers which exist in the understory of some stands can be expected to decline in vigor and exhibit a very slow growth rate or fall out of the stands because they are no longer able to survive under the increasingly dense overstory shade. Therefore, progress of these toward late-seral forest conditions would be slow. Snag recruitment within densely stocked stands is primarily a result of suppression mortality, with snags generally being recruited from the smaller trees within the stand.

Silvicultural treatment within the Riparian Reserves is appropriate to control stocking, reestablish and manage stands, and acquire desired vegetation characteristics needed to attain Aquatic Conservation Strategy objectives found on page B-11 of the Northwest Forest Plan (NFP) (USDA Forest Service and USDI Bureau of Land Management 1994).

Density management thinning of the Riparian Reserves (beyond the “no-harvest” buffers) is proposed for the following reasons:

- Maintain or increase the growth rates, vigor and crown development of many of the reserve (residual) trees, thus speeding up the general process of developing larger trees for eventual recruitment as large wood into the riparian area and potentially into the stream itself.

- Provide improved growing conditions for any conifer regeneration present in the understory, and the development or stimulation of vigorous shrub and herbaceous understory vegetation. Density management may also favor conditions for understory tree establishment and growth, particularly if shade-tolerant conifers are retained in the stands to provide a source of seed.

- Increase the wind-firmness of the reserve trees within the treated portion of the Riparian Reserves. This will help provide long-term protection for species and communities associated with the riparian zone.

- Add to the long-term diversity of stand characteristics throughout the Riparian Reserves and across the general project area.

- Density management thinning of the Riparian Reserves and leaving the portions in the "no-harvest" buffers untreated will increase the level of structural complexity within the Reserves and would be consistent with the objectives of the Aquatic Conservation Strategy contained in the Standards and Guidelines of the NFP (USDA Forest Service and USDI Bureau of Land Management 1994). Treatment as proposed within the Riparian Reserves would help to maintain and restore: (1) the distribution, diversity, and complexity of the forest types within the watershed while ensuring protection of the aquatic systems; (2) the species composition and structural diversity of plant communities within the Reserves; and (3) a future supply of larger-sized trees, which could become longer-lasting coarse woody debris.

- Treatment is not expected to retard restoration and maintenance of: (1) spatial and temporal connectivity within and between watersheds; (2) the physical integrity of the aquatic systems; (3) water quality necessary for the support of healthy riparian, aquatic, and wetland ecosystems; (4) the sediment regime under which aquatic ecosystems evolved; (5) in-stream flows needed to create and sustain riparian, aquatic, and wetland habitats and to retain sediment, nutrient, and wood routing patterns; (6) the timing, variability, and duration of floodplain inundation and water table elevation in wetlands and meadows; (7) habitat to support well-distributed populations of native, invertebrate, and vertebrate species that are riparian-dependent; and (8) species composition and structural diversity of plant communities in riparian areas and wetlands.

Table RR-1 summarizes the expected effects from implementing the recommended treatments on the Aquatic Conservation Strategy objectives.

Table RR-1. Checklist for documenting determination of compliance with the objectives of the Aquatic Conservation Strategy.

Aquatic Conservation Strategy Objective	Aquatic Conservation Strategy objective compliance determination	
	Meets objective	Does not prevent attainment of objective
1. Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted.	X	
2. Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species.		X
3. Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.		X
4. Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and mitigation of individuals composing aquatic and riparian communities.		X
5. Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.		X
6. Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.		X
7. Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.		X
8. Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability.	X	
9. Maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species.	X	

K. Silvicultural Treatment Recommendations

Density management treatment thinning:

- Thin the stands in a variable-spaced manner to the recommended *basal area* levels shown in TR-1. Thinning shall be done primarily from the Douglas-fir component and retain the other conifers and hardwoods in the stands. The stands are already heavily dominated by Douglas-fir for the most part and thinning in this manner will help to increase species diversity. Leave primarily the larger-diameter conifers (Douglas-fir in most cases) with relatively high live crown ratios and healthy appearing crowns (preferably with live crown ratios exceeding 35%), even at the expense of spacing. These trees will respond most favorably to the thinning and will also be more windfirm. This will be especially important for selecting the reserve trees in six 0.12-acre wide thinning patches to be created in the Riparian Reserve of Unit 25-1.

- Do *not* select trees greater than or equal to the diameter limits for the units as shown in Table DL-1 for removal, *regardless* of the basal area level in a particular area. The conifer diameter limits were determined to retain those trees that are generally 25% larger than the post-treatment quadratic mean diameter immediately after thinning or 24 inches, whichever is less. The objective is to maintain the largest trees in the stands. It is recognized that occasional larger-diameter trees may have to be cut to create skyline corridors, skid roads, or landing areas, but reasonable effort should be to avoid cutting these trees. When conifer trees greater than or equal to the diameter limit for a particular unit are cut, they are to remain on site for coarse wood enhancement. The hardwood diameter limit (=10 inches DBH) was designed to maintain the larger-sized hardwoods in the stands. Hardwoods =10 inches DBH could be either be marked for retention or reserved under a contract stipulation in the timber sale contract (hardwoods are to be included as part of the *total* basal area retention target levels when mixed with Douglas-fir or other conifers).

Table DL-1. Diameter cutting limits (DBH) for the treatment units in the Proposed Action in the environmental assessment for the Baker Creek Density Management Project.

Unit	Conifer diameter limit (DBH in inches)	Hardwood diameter limit (DBH in inches)
1-1	24	10
1-2	24	10
7-1	24	10
7-2, 3	18	10
25-1	18	10
29-1	20	10
31-1	22	10
33-1	22	10
35-1, 2	24	10

- Retain *all* hardwoods (no diameter limit) in obvious *P. weirii* root disease centers.

- Retain existing western hemlock, western redcedar, and grand fir understory trees.

- Reserve large trees with deformities at least in proportion to their occurrence in the stand.

- The network of "no-harvest" riparian buffers, wildlife roadside buffers along the well-traveled roads in T. 3S., R. 6W., sections 25 and 35 (see Project Record document 33), and adjacent dense stands outside of the treatment unit boundaries provide unthinned areas where suppression-related mortality (creation of smaller-sized snags and down logs) would continue to occur.

- If conifer trees need to be cut to create skyline corridors through "no-harvest" buffers, they should stay on site for coarse wood enhancement.

Treatment of *P. weirii* root disease centers:

- No specific treatment is recommended for small scattered areas less than ¼-acre that are infested with *P. weirii* other than removing the symptomatic Douglas-fir and grand fir trees and removing the Douglas-fir and grand fir trees in a one-tree spacing surrounding the infection center boundary. These small areas are serving as sources of larger-sized down wood and temporary snags and probably do not warrant treatment. In addition, should the infected trees blow over pulling a large part of their root systems out of the ground, this will help to reduce the spread of the disease. Well-defined root disease pockets more than ¼-acre (generally those exceeding ½-acre) may be reforested with disease-tolerant conifers such as western redcedar, or hardwoods such as bigleaf maple (all hardwoods are immune to *P. weirii* root rot) in the manner described for Unit 1-1 below.

- The following two alternative strategies for managing the *P. weirii* root disease centers in Units 25-1 and 1-1 are proposed as part of the AMA learning objectives for this project:

  (1) In unit 25-1 (this unit is in the RPA), a heavy thinning is proposed for the infested portions, leaving a resulting overstory canopy closure of at least 30%, with up to 10% of the area in patch-cut openings of up to ½-acre in size (a total of 5.4 acres in patch-cut openings). Susceptible trees (Douglas-fir and grand fir) that surround the boundary of obvious infection centers would be removed to reduce the potential for disease to spread to adjacent healthy parts of the stand through root contacts (bridge tree removal). Leaving some infected trees within the disease centers standing and having them blow over and removing a large part of the root system may be an effective means of reducing the amount of inoculum on the site. Windthrow, however, encourages Douglas-fir beetle populations to build up. Because of the heavy disease levels in the local area (diseased trees are under stress, and therefore are more susceptible to attack), a fair amount of subsequent Douglas-fir beetle damage may occur.

  (2) In unit 1-1, susceptible trees (Douglas-fir and grand fir) within heavily infested portions of the unit would be cut and removed, creating a series of patch cuts of up to 3 acres in size. Susceptible trees that surround the boundary of obvious infection centers would be removed to reduce the potential for disease to spread to adjacent healthy parts of the stand through root contacts (bridge tree removal).

(3) On both units, competing brush (*not existing hardwood trees—all hardwood trees are immune to P. weirii*) would be cut to a 6-inch stump height and bucked into lengths of 5 feet or less. Cut brush and logging slash could be hand-piled and burned (swamper burning) during the wet season or the bucked slash less than 6 inches in diameter at the small end could be scattered so that the slash depth is one foot or less to facilitate reforestation. Planting would be done with disease-resistant and/or immune tree species (primarily western redcedar and bigleaf maple). Use large-sized planting stock (1-1, P-1, or larger) and tube all planted trees for animal damage protection. Follow-up vegetation management treatments would be done to promote the survival and growth of the newly planted seedlings.

- Treatment of root disease centers in this way will help to reduce some of the impacts (non-stocked shrub-dominated openings) from this disease and at the same time, add to the overall species and structural diversity of the area. Root disease centers will *not* be treated within Riparian Reserves.

Other reforestation, including the six small (0.12-acre) wide-thinning patches in the Riparian Reserves along a non-fish-bearing intermittent stream in Unit 25-1:

- Use large-sized planting stock for reforestation (1-1, P-1, or larger) and tube all planted western redcedar and bigleaf maple to reduce big game browsing damage. To prepare these areas for planting, slash all brush to a 6-inch stump height, buck slash less than 6 inches in diameter at the small end into lengths of 5 feet or less, and scatter slash less than 6 inches in diameter at the small end so that the slash depth is one foot or less.

- To take advantage of the more open stand conditions created where cable yarding corridors converge near the landings, the area within a 100-foot radius downhill of the landings will be planted with shade-tolerant conifer seedlings such as western redcedar, grand fir, and/or western hemlock. Do not plant grand fir if these areas are infested with *P. weirii* root rot.

- Plant any subsoiled roads with red alder seedlings (1-0 bare root or one-year-old containerized planting stock) to supplement natural alder regeneration.

- For the six wide thinning patches created in Unit 25-1, plant with a mixture of shade-tolerant conifers primarily western hemlock, grand fir, and western redcedar, and/or bigleaf maple if available, to begin the formation of a second canopy layer. These areas will add to the overall diversity of the area by developing pockets of multi-storied, conifer-dominated stand types within the variable-spaced thinning in addition to encouraging rapid crown development of the selected large-diameter trees.

Timber harvesting considerations:

- In areas to be logged with ground-based equipment, use existing skid roads to the extent possible to reduce the potential soil impacts by concentrating them on areas that have already been impacted .

- Do not subsoil skid roads used in the ground-based logging areas because of concerns for root damage to the residual trees.

- Several landings should be used to harvest the timber. Landing size should be no larger than what is required to conduct a safe and efficient operation.

- Log lengths should be limited to 40 feet plus trim to reduce the potential for excessive residual stand damage.

- Felling and yarding operations should be restricted during the peak bark-slip period (generally May 1 to July 15) if excessive leave tree damage occurs.

Coarse woody debris (down wood and snags):

Current and anticipated coarse woody levels in the near-term following treatment generally fall within the moderate to high range shown in Table 24 of the Late-Successional Reserve Assessment for Oregon's Northern Coast Range Adaptive Management Area (USDA Forest Service and USDI Bureau of Land Management 1998) for all units except Units 7-2 and 7-3 (these units are only 34 years old), which is at the upper end of the minimum level. The large majority of the coarse wood, however, is from down wood.

- Retain existing coarse woody debris to the extent possible (includes down wood and snags).

- Any snags that are cut or are knocked over during logging should be left on site for coarse wood enhancement.

- A combination of coarse woody debris strategies # 2 and 3 outlined in the Late-Successional Reserve Assessment for Oregon's Northern Coast Range Adaptive Management Area (USDA Forest Service and USDI Bureau of Land Management 1998) seems appropriate here, focusing on maintaining live tree stocking levels which result in growing larger trees rapidly. At this time, creation of 2 Douglas-fir snags (snag-topped living trees) per acre is recommended from average or larger-sized leave trees in all units *except* Units 7-2, 7-3, 25-1, and 29-1. In the each of the six small wide thinning patches in Unit 25-1, creation of 2 snags (snag-topped living trees) is recommended from the designated trees (see Attachment 2). Favor trees for snag creation that are in the more relatively open areas within the thinning matrix. Do *not* choose trees for snag creation within or adjacent to *P. weirii* root disease centers, or closer than 150 feet from "open" roads or from a private property line. Units 7-2, 7-3, 25-1, and 29-1 do not contain a sufficient number of larger-sized trees for snag creation (greater than or equal to 20 inches DBH) (see Table SD-1) at this time. When conifers greater than or equal to the diameter limits as shown in Table DL-1 have to be cut to create skyline yarding corridors or skid trails, however, this can be used as an opportunity to enhance coarse wood levels by leaving these trees on site for down wood. Additional coarse wood (primarily snags) could be added at future stand entries 20 years or so after thining. As shown previously in Table TR-4, waiting for the trees to grow to larger size in response to the density management thinning can result in substantially higher individual tree volumes. Therefore, by delaying coarse woody debris input, these trees would have enhanced value as coarse woody debris. The total amount of coarse woody debris expected in the units after treatment and in the near future is shown in Table CW-1.

- Retain any *conifer* trees greater than or equal to the diameter limits shown in Table DL-1 that are felled to create cable yarding corridors or skid trails on site for coarse wood enhancement.

- Surround existing large snags (greater than 18"dbh) or other snags being actively used by wildlife with two or more leave trees to protect them from logging damage.

- Reserve two larger-diameter Douglas-fir trees spaced eight (8) feet or less apart at the rate of approximately *one* such “group” per acre where they occur. At a future date, one of these trees could potentially be converted into a snag, thus creating a "protected" snag for use by wildlife.

- If conifer trees are cut to create skyline corridors through “no-harvest” buffers, they should remain on site for coarse wood enhancement.

Table CW-1. Anticipated quantities of coarse woody debris (cubic feet per acre) in the near future after treatment as proposed in the Baker Creek Density Management Project.

	Unit								
Coarse woody debris source	1-1	1-2	7-1	7-2, 3	25-1	29-1	31-1	33-1	35-1, 2
Estimated harvest volume (cu ft/ac)	3,911	4,564	1,922	1,112	3,165	1,849	2,635	4,272	3,977
Damage and breakage during felling (3%)[1]	117	137	58	33	95	55	79	128	119
Limbs and tops (2%)[1]	78	91	38	22	63	37	53	85	80
Leave tree QMD (nearest 1 inch)	21	23	19	14	14	15	19	19	20
Mean tree volume (cu ft)	97	114	70	32	32	35	70	70	90
Post-treatment windthrow (0.5 to 2 trees/ac)	194	57	70	16	64	18	35	35	90
Created down wood [2]	111	167	56	19	31	81	83	104	97
Created snags	208	278	278	0	0	0	179	179	179
Existing down[3] wood	2,094	1,442	2,153	869	1,494	1,600	711	1,153	4,846
Existing snags[3]	216	180	284	20	60	209	438	779	174
Total	3,136	2,488	3,026	1,026	1,854	2,050	1,667	2,553	5,694

[1]Percentage of estimated harvest volume. [2]Conifer trees *potentially* cut to create skyline corridors or skid trails greater than or equal to the conifer diameter limit. [3]Includes stands adjacent to stands proposed for density management and does not include damaged trees (trees with broken or forked tops, leaning trees, or trees infected with *P. weirii* root rot).

Near-term post-harvest treatments in the patch-cut areas, planted root disease centers, and planted areas around cable-yarding landings:

- In any planted *P. weirii* root rot pockets, planted areas around landings, and in the planted wide thinning patches in the Riparian Reserves of Unit 25-1, follow-up vegetation management treatments will probably be needed within the first 5 to 8 years after planting. Up to three vegetation management treatments may be needed to assure seedling growth and survival and eventual conifer establishment on these planting sites.
- Precommercial thinning of planted root disease pockets, planted areas around landings,

planted wide thinning patches in the Riparian Reserves of Unit 25-1, and other areas of dense natural regeneration may be appropriate at age 12 to 15 years to promote understory tree growth and adjust species composition.

L. Recommended monitoring

Stand development monitoring in the density management areas:

To monitor the general development of the stand as a result of implementing this prescription, forest stand surveys (stand exams) using the Atterbury stand exam program (or the equivalent) should be done at one, 10, and 20 years following treatment. Data collected in the stand exam should include the following:

- Overstory tree data: Tree species, number of trees per acre, diameter at breast height, diameter growth for the last 5 years in tenths of an inch, basal area per acre, live crown ratio, canopy closure, height of the dominant trees, volume per acre, and tree damage (includes damage from insects and disease).

- Snags: Tree species, number of snags per acre, diameter at breast height, total height, volume (cubic feet per acre), and decay class.

- Down wood: Volume per acre (cubic feet), pieces per acre, and total length per acre by log type (conifer or hardwood) and decay class.

- Understory shrubs and herbs: Species composition, canopy cover and height by layer, and frequency of occurrence.

- Understory tree data: tree species, number of trees per acre, diameter at breast height, basal area per acre, and height.

Monitoring to assess attainment of AMA learning objectives:

Recommended monitoring of the two AMA learning objective projects: (1) comparison of two strategies for managing areas of severe *P. weirii* root disease infestation and (2) development of large trees and snags in selected dense conifer-dominated pockets within the Riparian Reserves, including a portion of the "no-harvest" buffer, on a portion of an intermittent, non-fish-bearing stream are described in Attachments 1 and 2, respectively.

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Attachment 1. **Comparison of two strategies for managing areas of severe *Phellinus weirii* root disease infestation.**

Introduction

Section 25 of T. 3S., R. 6W. is known to have high levels of *Phellinus weirii* root disease. In 1988, a forest pest evaluation was done on 60 acres in the southwest corner of section 25 by forest pathologists from Forest Pest Management[1]. Forty-four percent of the survey plots were in infection centers. Survey plots occurring in disease centers only contained 29% as many trees and 28% as much basal area (a rough equivalent to volume) as did uninfected plots. They also noted that stands over a large part of section 25 had severe root disease. The report estimated that about 75% of the area had levels of disease similar to that in the southwest portion of the section that was intensively sampled for root disease. Based on the timber production management objectives for the area at that time, the report recommended clearcutting diseased Douglas-fir stands as soon as the minimum merchantable tree size was attained because of unacceptably high levels of Douglas-fir (timber volume) losses. In general, Douglas-fir volume in *P. weirii* root disease centers is thought to be about half of that in healthy portions of affected stands.

Extensive *P. weirii* root disease was observed on our field visits to the D2- = 1963 stand being considered for density management treatment in section 25 (proposed Unit 25-1) during the summer of 2000. Based on estimates interpreted from the most recent aerial photos of the unit and verified by field checking on August 8, 2002, it appears that over 30% of the unit is in *P. weirii* root disease centers. This is probably a conservative estimate and is somewhat lower than the survey findings in the above-referenced forest Pest Management report. There is an estimated total of about 54 acres containing disease centers in this unit. Individual disease centers range from about 3 to 14 acres in size. From a silvicultural perspective, it seems unlikely that Douglas-fir stands with older-forest structure will develop if left unmanaged. As the Douglas-fir dies, the growing space is occupied by a variety of shrubs, including salal, vine maple, and oceanspray. There appears to be little regeneration of resistant tree species in disease centers on this site, which may be a function of lack of seed source and intense shrub competition. To make progress toward attaining a more stable and structurally diverse stand, the spread of the disease needs to be limited and resistant and/or immune tree species need to be established on the infected portions of the stand. Management options, however, are somewhat limited in Unit 25-1 (167 total acres) in order to accomplish USFWS consultation ptogrammatically and avoid the more costly and time-consuming project-specific consultation process. This is because Unit 25-1 is within a Reserve Pair Area (RPA) for the northern spotted owl. At least 30% canopy closure is to be maintained in stands in the RPA in order to consult programmatically.

[1]Goheen, D.J., and E.M. Goheen. 1988. Forest pest evaluation of the Ball Bearing Hill-High Heaven unit, Yamhill Resource Area, Salem District, Bureau of Land Management. USDA Forest Service, Forest Pest Management. R6-88-02. 9p.

Unit 1-1 in T. 4S., R. 6W. Section 1 also has extensive areas that are heavily infested with *P. weirii* root disease. Although no disease survey data are available for this unit, the level of infection appears similar to the level in Unit 25-1. Based on estimates using aerial photographs combined with ground-checking of some sites, at least 20% of Unit 1-1 (103 total acres) is in *P. weirii* root disease centers. Unit 1-1, however, is outside of the RPA boundary, so the canopy cover limitation does not apply here. Therefore, there is an opportunity to test the effectiveness of two approaches to managing areas that are heavily infested with *P. weirii*.

Methods

We propose implementing the following two different strategies for managing the *P. weirii* root disease centers in Units 25-1 and 1-1:

In Unit 25-1, a heavy thinning is proposed for the infested portions, leaving a resulting overstory canopy closure of at least 30%, with up to 10% of the area in patch-cut openings of up to ½-acre in size. Susceptible trees that surround the boundary of obvious infection centers would be removed to reduce the potential for disease to spread to adjacent healthy parts of the stand through root contacts (bridge tree removal). Leaving infected trees standing and having them blow over and removing a large part of the root system may be an effective means of reducing the amount of inoculum on the site. Windthrow, however, encourages Douglas-fir beetle populations to build up. Because of the heavy disease levels in the local area (diseased trees are under stress, and therefore are more susceptible to attack), a fair amount of subsequent Douglas-fir beetle damage may occur.

In Unit 1-1, susceptible trees within heavily infested portions of the unit would be cut and removed, creating a series of patch cuts of up to 3 acres in size. Susceptible trees that surround the boundary of obvious infection centers would be removed to reduce the potential for disease to spread to adjacent healthy parts of the stand through root contacts (bridge tree removal).

On both units, competing brush (*not existing hardwood trees—all hardwood trees are immune to P. weirii*) would be cut to a 6-inch stump height and bucked into lengths of 5 feet or less. Cut brush and logging slash could be hand-piled and burned (swamper burning) during the wet season or the bucked slash less than 6 inches in diameter at the small end could be scattered so that the slash depth is one foot or less to facilitate reforestation. Planting would be done with disease-resistant and/or immune tree species. Use large-sized planting stock (1-1, P-1, or larger) and tube all planted trees for animal damage protection. Follow-up vegetation management treatments would be done to promote the survival and growth of the newly planted seedlings.

Suggested monitoring

Disease surveys could be conducted at 1, 5, and 10 years after treatment to evaluate the relative effectiveness of these two disease management strategies in reducing current and future disease-related impacts as well as and promoting the attainment of older forest characteristics. Surveys could be done using permanently located or randomly selected plots. Photo taken from permanently located photo points would also be very helpful in assessing the effectiveness of these two approaches.

Attachment 2. Development of large trees and snags in selected dense conifer-dominated pockets with the Riparian Reserves, including a portion of the "no-harvest" buffer, on a portion of an intermittent, non-fish-bearing stream in the southeast portion of T. 3S., R. 6W., Sec. 25 (Unit 25-1) in the Baker Creek Project area

Introduction

The presence of large conifers is recognized as an important habitat component of riparian ecosystems. Dense conifer stocking along some streams, however, will prevent or drastically slow the rate at which large diameter trees can develop. Trees growing at relatively high densities also typically have smaller diameters in relation to their height and have a lower proportion of their boles supporting live crown. This is especially true for species, such as Douglas-fir, which are classified as intolerant to shade. Trees with shorter crowns are much less able to respond to release from competition than trees with longer crowns because the crown is the food manufacturing apparatus for the tree. The objective of this field trial is to see if individual large-diameter trees can be developed by relatively wide thinning in selected areas within the Riparian Reserve, including a portion of the 50-foot "no-harvest" buffer, along an intermittent, non-fish-bearing stream without causing unacceptable short-term impacts to the stream.

Methods

On December 2, 2002, Walt Kastner, Bob McDonald, Matt Walker, Bill Wais, Mike Allen, and Doug Stout, identified areas of dense Douglas-fir stocking in the 41-year-old stand along an intermittent, non-fish-bearing stream in the southeast portion of T. 3S., R. 6W., Sec. 25 in the Baker Creek Project area (Unit 25-1) suitable for relatively wide thinning of individual pairs of trees. Six such areas along approximately 700 feet of stream length were identified. Four areas were on the north side of the stream and two areas were on the south side of the stream. Within each area, two of the largest-diameter trees (usually within about 25 feet of each other) were selected as the leave trees (trees to be left) and flagged with orange flagging. Two of the larger trees near the leave trees were selected to be converted into snags for wildlife habitat enhancement and flagged with yellow flagging. Then a thinning boundary of about 35 to 40 feet around the selected leave trees was flagged with blue flagging. The locations of the six wide thinning patches (riparian treatment areas) are shown in Figure 1. The total treatment area for all six thinning patches is approximately 0.7 acres. All of the trees except those designated as leave trees or trees to be converted into snags will be cut and removed. The wide thinning patches were separated by a distance of at least 50 feet, no patches were closer to the stream than 10 to 15 feet at their closest point, and patches on one side of the stream were not opposite those on the other side of the stream. In addition, dominant trees were retained along the stream edge.

To further increase the structural and species diversity of the widely-spaced patches, they will be planted with shade-tolerant conifers (western redcedar, western hemlock, grand fir, or a mixture of some or all of these species).

Suggested monitoring

It is suggested that pre-and post-treatment solar radiation monitoring sites be established along the stream to determine if there is an increase in solar radiation reaching the stream as a result of the treatment. If there is an increase in solar radiation, determine the duration of the increase over a period of 10 years. It may useful to collect data at the same time of year from the same monitoring sites at the following intervals: (1) prior to treatment, (2) one year after treatment, (3) five years year after treatment, and (4) 10 years year after treatment. The five- and 10-year measurements may be deleted if there is no increase in solar radiation at the first-year post-treatment measurement. In addition, pre- and post-treatment photos may be useful and could be taken from the same locations and at the same time the solar radiation data is collected.

Figure 1. Location of the six wide thinning patches (riparian treatment areas) in Unit 25-1 of the Baker Creek Project.